

Castle Pines Master Transportation Plan

APRIL 2017



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CASTLE PINES

MASTER TRANSPORTATION PLAN

FINAL

DATE

April 2017

PREPARED FOR



City of Castle Pines

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EXECUTIVE SUMMARY

Castle Pines residents today enjoy a high standard of living, extensive recreational opportunities, and a quiet residential community setting. To maintain and enhance that quality of life, and to ensure the long-term viability of the community, will require decision-makers and residents to consider the role that transportation infrastructure plays in the City today, and what role it might play in the future.

Castle Pines is a largely auto-dependent community. Residents commonly leave the community to access general services and to travel to work – 97% of residents who travel for work leave the City of Castle Pines – while local workers travel from outside of Castle Pines to fill the jobs available in the community. This dynamic means there is a heavy reliance on Castle Pines Pkwy for travel within the City, and on I-25 for regional travel needs. Castle Pines is likely to remain highly dependent on single-occupancy vehicle travel for the foreseeable future; however, Castle Pines residents have identified a desire for increased multi-modal transportation options.

Although Castle Pines offers an extensive network of paved recreational trails, the network is not well-connected in all places, and on-street bicycle and pedestrian facilities are limited. As a result, completing basic trips by bicycling or walking can be difficult. To meet the evolving needs of its residents over time, Castle Pines can pursue a multi-modal transportation system that balances the need for increased transportation options with a more efficient flow of vehicle traffic.

At the same time, Castle Pines must confront its existing infrastructure needs. Maintenance costs for City-owned roads are increasing as much of the infrastructure was built more than three decades ago; due to the impacts of weather and normal wear and tear, many roadways will need to be replaced in the coming years. With these challenges comes the opportunity to rethink the form and function of City roadways. In particular, roadway reconstruction provides the City of Castle Pines the chance to create a transportation system that meets the needs of a greater range of users, while preserving vehicular access into and out of the community.

The Castle Pines Master Transportation Plan builds upon the recently-adopted Comprehensive Plan. Where the Comprehensive Plan identifies general priorities, the Master Transportation Plan contains multiple implementation measures that address

the City's infrastructure needs and support the Comprehensive Plan's goals and objectives. Implementation measures include:

- A **Blueprint Process** that applies a common set of analyses and strategies to enable appropriate investment decisions to be made given the existing transportation infrastructure and the surrounding land use context. A benefit of the Blueprint Process is the ability to contrast existing conditions and against the desired infrastructure (e.g. the ideal roadway cross-section), and evaluate potential improvements. The Blueprint Process is intended to be applied to existing roadways.
- **Roadway design guidance** supports the Blueprint Process by outlining the types of roadway infrastructure that are appropriate and desirable on different corridor types, and defines the desired dimensions of those roadway elements. Design guidance complements national technical standards and ensures that transportation infrastructure enhances community character. The design guidance should be consulted by both private developers and City staff during the roadway design process. See page 55 for essential details.
- **Community design characteristics** include visual markers, signage, symbols, landscaping, and other elements that let residents and visitors alike know they are in Castle Pines. Applying design characteristics across the established and newly-developing areas of Castle Pines also provides an opportunity to forge a common identity through transportation infrastructure.
- **Policy recommendations** that address general steps that Castle Pines can take to improve transportation options. Recommendations include participation in regional planning agencies, which would ensure Castle Pines is represented in the regional dialogue on growth patterns, roadway and transit expansion projects, funding opportunities, and the best means of addressing transportation needs. Other policy options that could be pursued include asset management and Complete Streets programs and policies, or a travel demand management program to support ridesharing and use of alternative modes of transportation and create greater options for Castle Pines residents.

INTRODUCTION AND PLAN VISION

Like many young communities, Castle Pines is still building its identity. Incorporated in 2008, Castle Pines lies along Interstate 25 (I-25) about 20 miles south of downtown Denver. The city features tremendous growth potential as the recently annexed eastern half of Castle Pines is almost entirely vacant. This document outlines steps that may be taken to meet the transportation needs of current and future residents.

Recent planning efforts illuminate recent trends and provide guidance on how best to manage growth and how best to capitalize on growth-related opportunities. In particular, Castle Pines faces conflicting challenges:

- Residents demonstrate auto-oriented commuting patterns, but Castle Pines is a community that values recreational trails and opportunities to access local businesses without a car.
- Castle Pines is located in a suburban setting, but is part of the fast-growing Denver metropolitan area. Castle Pines is therefore affected by regional growth patterns and changing transportation conditions.
- As a largely residential community, there is a need to provide efficient access and egress for local residents, but residents also express a strong desire to provide safe roadways and support travel by multiple modes of transportation.

Within this context, Castle Pines has developed a general vision for itself as a community noted for “excellent infrastructure, safe neighborhoods, a strong sense of community and conscientious development that balances open space, residential and commercial uses.”¹ Castle Pines boasts a high quality of life, exemplified by the large amounts of open space and parks relative to its population, as well as an extensive network of paved trails.

As currently undeveloped areas of the city build out, the question becomes: what role does transportation infrastructure play in the enhancement of local quality of life? To maintain that quality of life as it grows and to reinforce a strong community identity over time, Castle Pines must establish the type of infrastructure and transportation

¹ Castle Pines Vision Statement - <http://www.castlepinesgov.com/vision-and-goals>

City of Castle Pines Vision Statement

“Enhance our unique character by ensuring excellent infrastructure, safe neighborhoods, a strong sense of community and conscientious development that balances open space, residential and commercial uses.”

(City of Castle Pines website)

Key Concepts from Comprehensive Plan Visioning Exercise

- Small town community
- Open space
- Trails
- Variety of parks
- Friendly neighborhoods

Comprehensive Plan Transportation Vision

A transportation network “that facilitates a safe and connected community through off-street and on-street pathways, a highly connected road system, new transportation options, and unique gateway features, streetscape improvements and signage that represents the community’s unique character.”

Additional discussion on the Comprehensive Plan can be found in the “Transportation Initiatives and Regional Coordination” section.

options that are available to its residents, visitors to the community, and employees of local businesses.

The Castle Pines Master Transportation Plan builds on recent planning efforts to provide guidance on the role of transportation in community identity and supporting local objectives. The most critical of these planning documents is the Castle Pines Comprehensive Plan. The Comprehensive Plan provides policy guidance and establishes a set of general priorities that provide the context for future investments and programs. Other more localized or topic-specific plans provide guidance on particular roadways, such as the Multi-Modal Enhancement Plan, or municipal services, as is the case with the Parks and Recreation Comprehensive Plan (PaRC Plan).

The creation of a community with high quality infrastructure and residential character requires a clear vision for future transportation investments and improvements to the existing system. The **goals and objectives of the Master Transportation Plan align with the Castle Pines Comprehensive Plan to encourage transportation initiatives that support community character.** This approach includes a connection to *economic development* through the construction of infrastructure that supports neighborhood commercial and retail activity. There are widespread benefits that may be achieved from building a coherent and consistent network of roads, sidewalks, bicycle facilities, and trails. The Transportation Plan acknowledges that creating places where people want to be is the best form of economic development.

The Comprehensive Plan identifies a series of transportation-related challenges and concerns, including: alleviating *traffic congestion*; reconfiguring the *I-25 / Castle Pines Parkway (Pkwy) interchange* to improve bicycle and pedestrian access to commercial areas; *traffic calming*

measures where appropriate; *sidewalk and bicycle connections between neighborhoods and shopping areas*; enhanced *regional bike route connectivity*; and *regional transportation connections* to transportation hubs to enable Castle Pines residents to effectively access the rest of the Denver metropolitan area.

A review of these challenges highlights the need for a transportation infrastructure decision-making process that can be applied to a range of situations. To address the concerns and limitations discussed in the Comprehensive Plan, the Master Transportation Plan offers a framework to aid local decision-makers in developing projects that support local objectives and build a high-performing and multi-modal transportation network over time. Four issues serve as guiding principles for the Master Transportation Plan:

- Community Character
- Managing Congestion
- Site Access and Local Connectivity
- Bicycle and Pedestrian Facilities

The decision-making framework contained in the plan, the **Blueprint Process**, is accompanied by **Roadway Design Guidance** that describes desired roadway elements and their dimensions. Collectively, these products ensure that potential investments make sense given the surrounding context, such as how to provide bicycle and pedestrian infrastructure where it does not exist, or to improve access to individual sites, and ensure that Castle Pines develops a balanced transportation system over time.

The Blueprint Process, roadway design guidance, and a discussion of policy options comprise the implementation elements of the Master Transportation Plan. These tools specifically encourage infrastructure investments that support community character and support place-making efforts in Castle Pines. In addition to desired roadway elements, community character is discussed through proposed infrastructure design elements that let residents and visitors alike know they are in Castle Pines.

GOALS AND OBJECTIVES

Goals

Goal I: Develop a safe, efficient, multi-functional transportation network designed to promote connections to local destinations.

Goal II: Facilitate cost-effective operations and roadway maintenance strategies.

Goal III: Develop the bicycle infrastructure network to support increased commuting trips and serve the needs of all types of cyclists.

Goal IV: Increase pedestrian connectivity, accessibility, safety, and comfort.

Goal V: Facilitate future opportunities for Castle Pines residents to access regional destinations via public transit.

Goal VI: Develop transportation infrastructure that supports mixed-use development and walkable retail centers.

Objectives

- Connect adjoining neighborhoods, community facilities, and services (public/private).
- Ensure consistency local, regional, and statewide transportation plans.
- Support traffic calming and streetscape design on local streets.
- Expand network connectivity with parallel east/west and north/south routes through construction of new roads or connection of existing roads.
- Uphold the quality, connectivity, and maintenance of local and arterial roadways.
- Provide adequate primary, secondary, and emergency road connections for all neighborhoods.
- Improve efficiency of travel along principal arterials through smooth traffic flows.
- Create a continuous paved path system around the City, connecting neighborhoods, parks, schools, and commercial areas.
- Complete a system of connected on-street and off-street bicycle facilities along or parallel to major roads.
- Develop programs that encourage bicycling activity, including education and training.
- Enhance bicycle access to retail destinations, both local and regional.
- Create comfortable and safe pedestrian connections and crossings that encourage walking.
- Complete a system of connected on-street and off-street pedestrian facilities along or parallel to major roads.
- Develop programs that encourage pedestrian activity, including education and training.
- Enhance pedestrian access between neighborhoods and retail destinations.
- Support multi-modal transportation solutions to connect residents to nearby Regional Transportation District facilities.
- Identify potential sites for public transit facilities and related pedestrian and bicycle connections.
- Anticipate potential rail expansion, transit facilities, and park and rides within Mixed-Use Downtown and Mixed-Use Market areas.
- Enhance vehicular and pedestrian connectivity and mobility within all mixed-use areas
- Encourage transit-supportive densities and mixed-use development near the interchange of I-25 and Castle Pines Pkwy and other potential transit station areas.

CITY PROFILE

Demographics

Population and Housing

Castle Pines is a primarily residential community located along I-25 in the southern portion of the Denver metropolitan area. According to annual population estimates provided by the Census, Castle Pines had a population of approximately 10,347 people in 2015.²

Housing in Castle Pines is comprised predominantly of single-family units at 86%, while 13% of units are multi-family and 1% classified as other housing types.³ The percentage of single-family homes in Douglas County is only slightly less than that of Castle Pines at 84%, while single-family homes make up only 54% of the housing stock in the city of Denver (multi-family units comprise 46% of the City of Denver housing stock). A high percentage of Castle Pines households are owner-occupied (83%), which is consistent with the suburban residential character of the community. By contrast, only 50% of households in the city of Denver are owner-occupied.⁴



CASTLE PINES RESIDENTIAL

According to the 2010-2014 American Community Survey, the racial composition of Castle Pines is 94% White, 1% Black or African American, 2% Asian, and 3% Two or more races, while 6% identify as Hispanic or Latino. Douglas County's racial composition is very similar to Castle Pines, with 91% White, 1% Black or African American, 4% Asian, 1% some other race, and 3% two or more races, with 8% identifying as Hispanic or Latino.

² Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2015

³ 2010-2014 American Community Survey (ACS) 5-Year Estimates

⁴ Image Credit: <http://castlepines-realestate.com/castle-pines-co-homes-for-sale/castle-pines-co-neighborhoods/homes-in-turquoise-terrace-castle-pines-co/>

The median household income in Castle Pines is \$137,426, which is nearly \$35,000 more per year than the median household income for Douglas County, and approximately \$85,000 more per year than that of the city of Denver.

Employment

Working professionals who reside in Castle Pines are largely employed outside of the city and work in a variety of generally white collar occupations. According to OnTheMap Longitudinal Employment Household Dynamics, the most common professions among Castle Pines residents include finance and insurance sector; professional, scientific, and technical services; educational services; and the health care and social assistance sector.

TABLE 1 CASTLE PINES WORKFORCE BY INDUSTRY

Jobs by NAICS (2014)	Jobs held by Castle Pines Residents	Jobs located in Castle Pines	Jobs located in Denver MSA
Agriculture, Forestry, Fishing and Hunting	0.2%	0.6%	0.2%
Mining, Quarrying, and Oil and Gas Extraction	1.3%	0.4%	1.0%
Utilities	0.5%	1.2%	0.5%
Construction	4.1%	2.4%	5.7%
Manufacturing	3.2%	1.3%	5.1%
Wholesale Trade	5.8%	5.1%	5.3%
Retail Trade	9.1%	17.7%	10.1%
Transportation and Warehousing	2.3%	0.2%	3.6%
Information	6.3%	0.8%	3.6%
Finance and Insurance	9.0%	7.8%	5.4%
Real Estate and Rental and Leasing	2.2%	2.4%	1.9%
Professional, Scientific, and Technical Services	13.2%	15.3%	9.3%
Management of Companies and Enterprises	3.1%	1.9%	2.4%
Administration & Support, Waste Management and Remediation	5.5%	6.5%	6.8%
Educational Services	8.0%	6.4%	7.7%
Health Care and Social Assistance	10.2%	5.6%	12.3%
Arts, Entertainment, and Recreation	2.8%	3.6%	1.8%
Accommodation and Food Services	7.0%	17.7%	9.2%
Other Services (excluding Public Administration)	2.9%	2.4%	3.1%
Public Administration	3.3%	0.5%	4.9%
Total Jobs	4,815	1,225	1,342,839

SOURCE: ONTHEMAP, LONGITUDINAL EMPLOYMENT HOUSEHOLD DYNAMICS

The types of jobs available in Castle Pines are disproportionately found in the retail trade and food service sectors. The relatively low incomes associated with these jobs creates the need for Castle Pines to import its workforce from surrounding areas. As a result, service sector jobs are primarily filled by workers who reside outside of Castle Pines. A high share of jobs in Castle Pines are also found in the professional, scientific, and technical service sector, though it is possible that many of these jobs are filled by residents who work from home (see discussion on commuting patterns).

Commuting

A large percentage of the employed residents in Castle Pines travel outside of the city and Douglas County in order to reach their place of work. According to the OnTheMap inflow-outflow data, which profiles the movement of employed individuals across jurisdictional boundaries, only 3% of jobs in Castle Pines are filled by Castle Pines residents. A large number of Castle Pines residents work at home (12% according to 2014 ACS data), with the remainder commuting outside of City limits.

Figure 1 depicts the locations of job sites for residents of Castle Pines. Since there are limited opportunities to both live and work in town, there is a heavy reliance on I-25 for work access. Work sites of employed residents are dispersed across Denver metropolitan area, with concentrations found in Downtown Denver, the Denver Tech Center, along I-25 through Centennial, and in the Town of Castle Rock.

Most employed residents in Castle Pines have a relatively typical commute to get to work in terms of time. The average travel time for Castle Pines

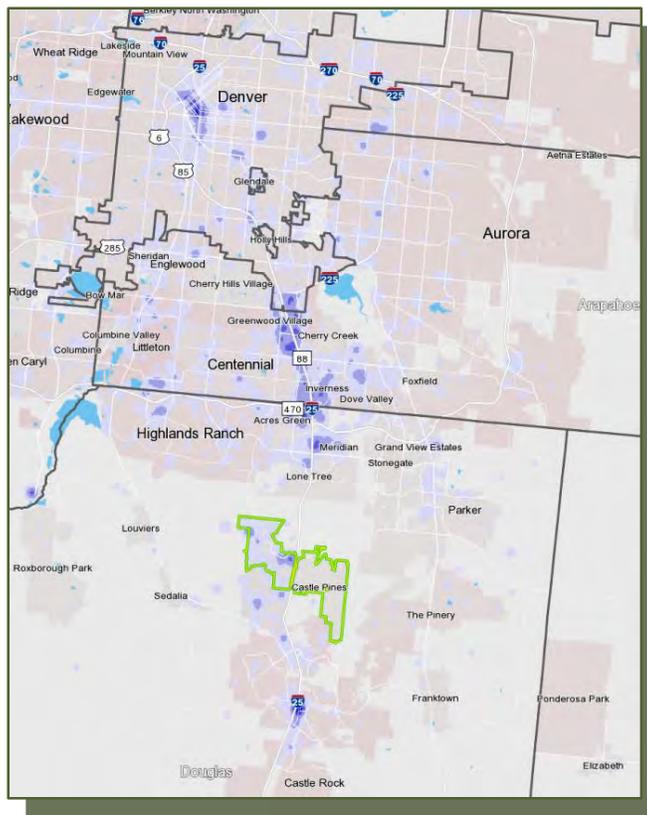
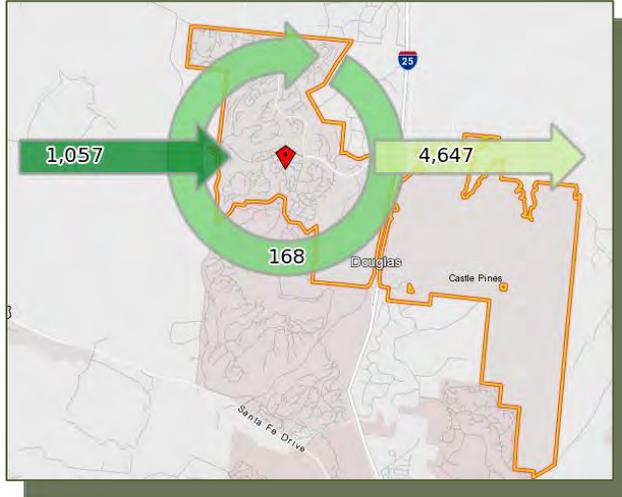


FIGURE 1 DISTRIBUTION OF WORK SITES FOR CASTLE PINES RESIDENTS

residents to reach their place of work is 26.5 minutes, with the majority of workers (67%) traveling for 20 minutes or more. In comparison, the average travel time for Denver city residents is 24.5 minutes, with 60% of workers traveling more than 20 minutes to get to work. The average commute time could potentially be moderated



by the high percentage of individuals who work at home. The

FIGURE 2 COMMUTING INFLOW-OUTFLOW FOR CASTLE PINES RESIDENTS AND WORKERS

median travel time is therefore expected to be higher than the 26.5 minutes indicated in the American Community Survey. According to the 2010-2014 ACS, 86% of Castle Pines residents commute to work by private vehicle. Approximately 1% used public transportation, 1% used a taxicab, motorcycle, or other means, and 12% worked from home. The majority of employed residents in Castle Pines have their own vehicles, with 88% of households having two or more vehicles available. This makes Castle Pines substantially more auto-dependent than the city of Denver, where only 79% commute by private vehicle and 6% work at home.

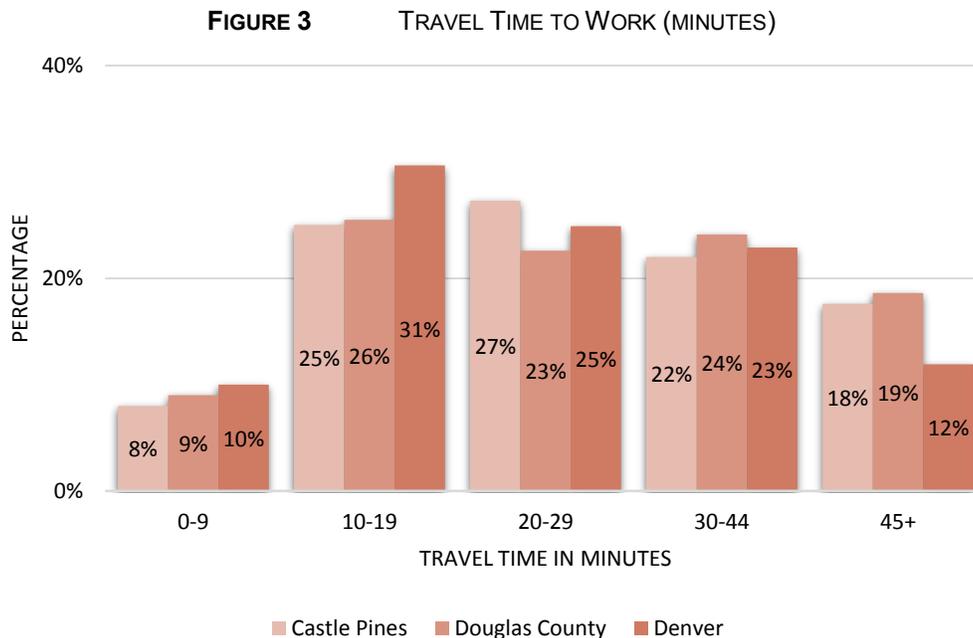
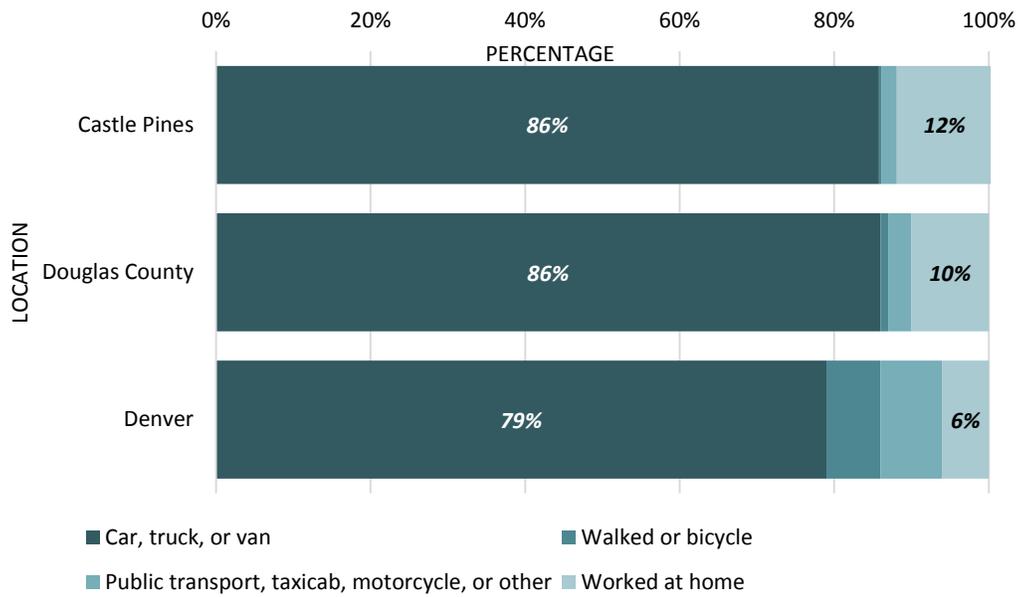


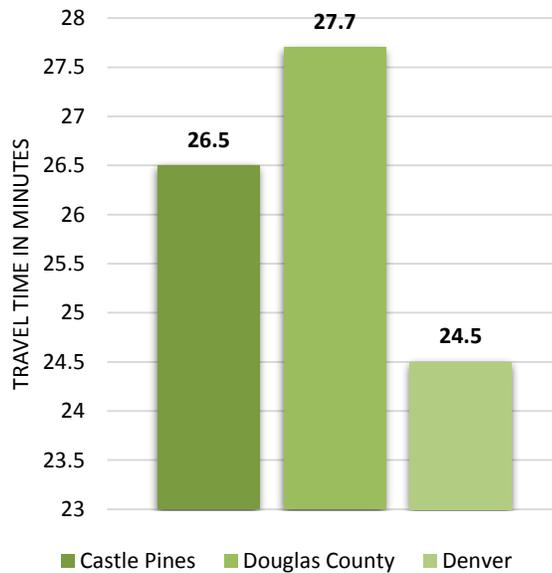
FIGURE 4 MEANS OF TRANSPORTATION TO WORK



Employment and Housing Projections

According to the 2040 population and employment forecasts developed by DRCOG, Castle Pines is expected to grow significantly in the currently undeveloped areas of the city. The locations that are projected to experience the most substantial population growth are the Canyons Planned Development, Lagae Ranch, and Castle Pines Town Center.

FIGURE 5 MEAN TRAVEL TIME (MINUTES)



According to the Comprehensive Plan, the Canyons Planned Development is expected to result in approximately 2,500 single-family households. The Town Center is expected to grow by approximately 475 single-family households and 200 multi-family households. The development of Lagae Ranch will also lead to an additional

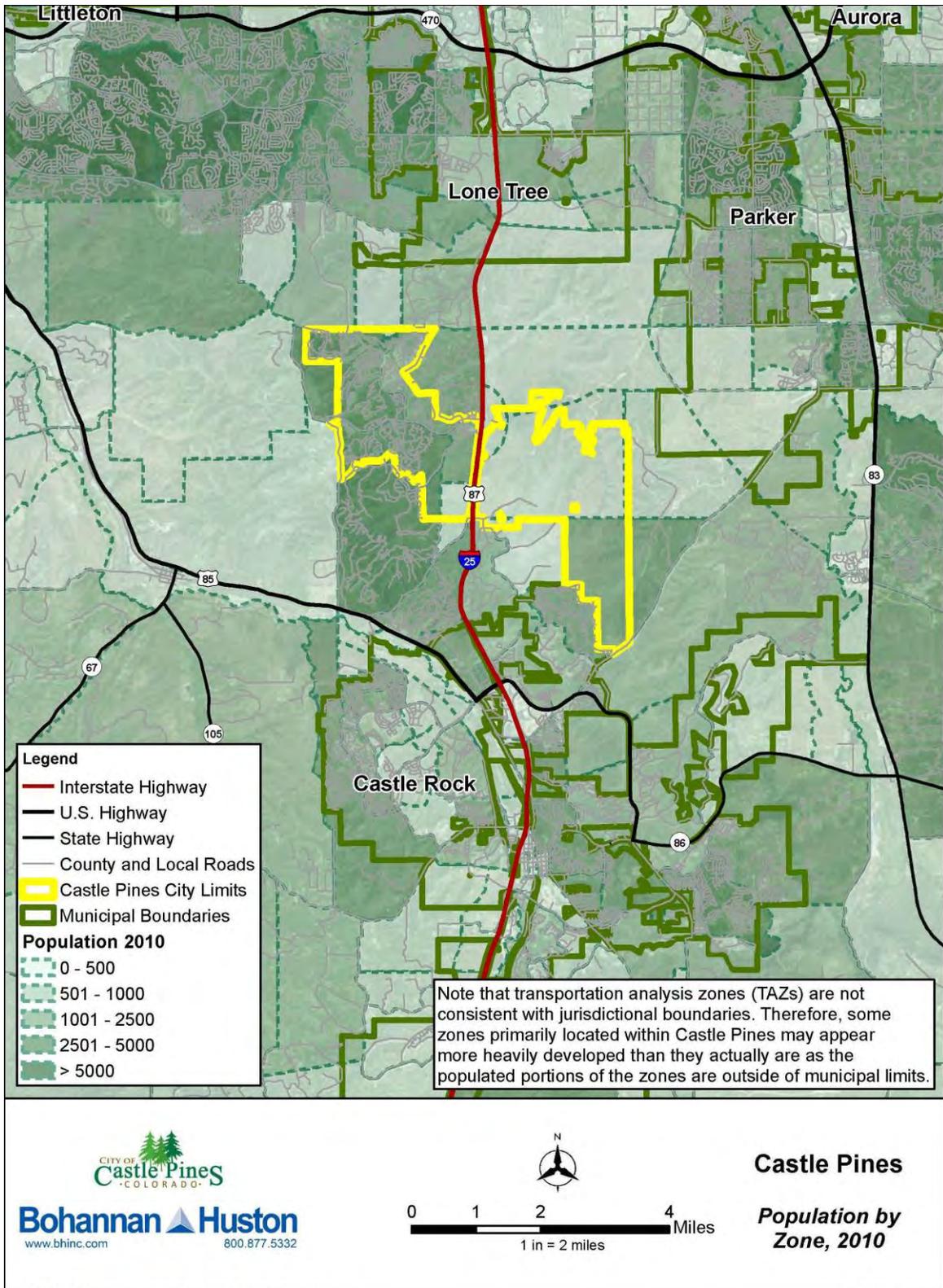
231 single-family households and 400 multi-family households. The currently developed portions of Castle Pines to the west of I-25, with the exception of the Town Center and Lagae Ranch areas, are not expected to experience significant population or employment growth.



CASTLE PINES OPEN SPACE

New developments will result in increased commercial activity and employment opportunities. The Canyons proposes approximately 225 acres of commercial development, the Town Center is expected to include 11.5 acres of mixed-use activity, and the Lagae Ranch development contains 9 acres of commercial and non-residential space.

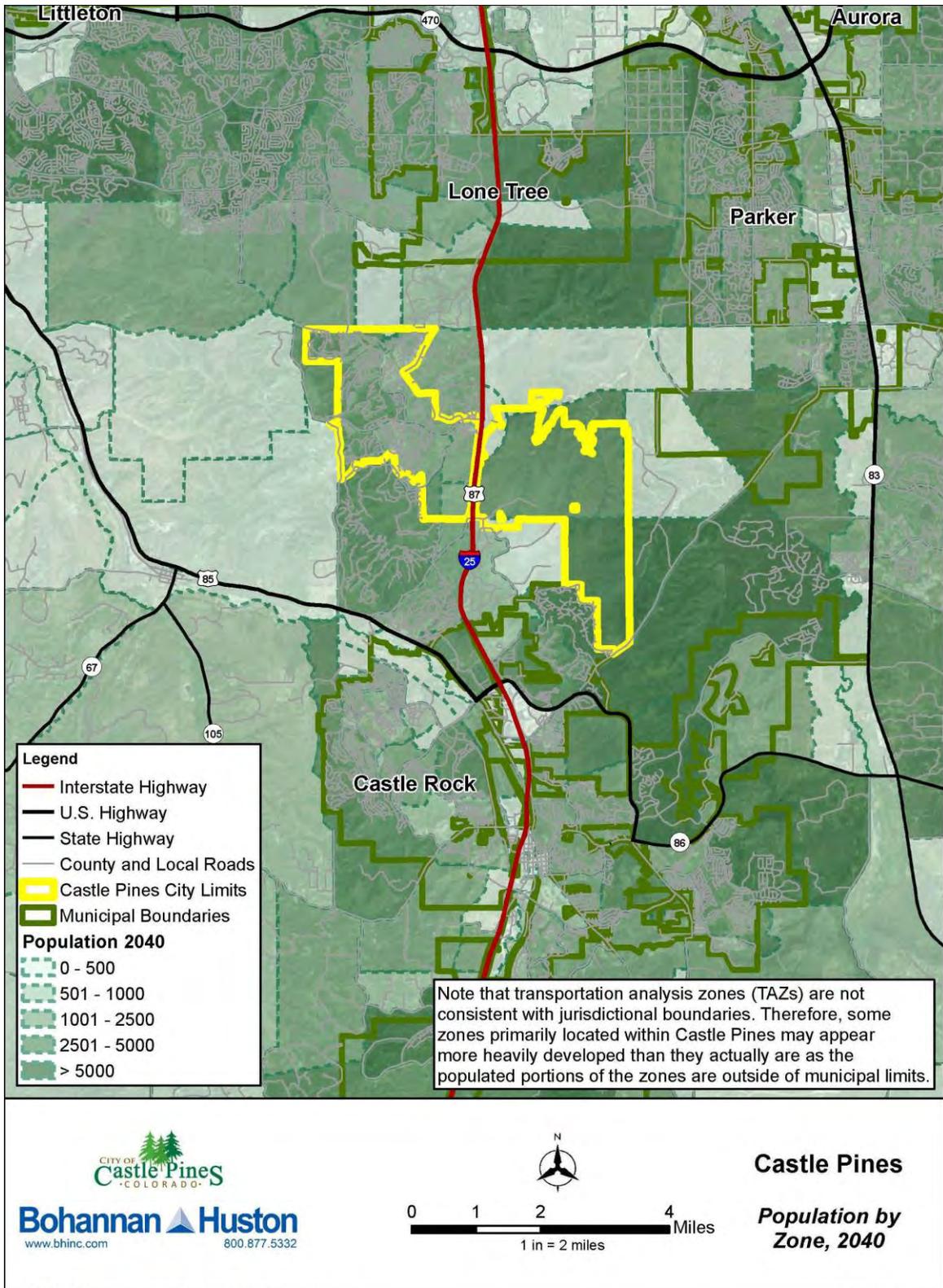
Figures 6-11 depict total population and employment by transportation analysis zone (TAZ) – a unit of analysis similar to a Census block group used for regional transportation planning purposes – for the years 2010 and 2040, as well as growth rates from 2010-2040. TAZ-level forecasts are developed by DRCOG for the entire Denver metropolitan area; projections for the Castle Pines area were developed by DRCOG in consultation with Douglas County staff. Since there is uncertainty inherent in predicting actual growth by location, the future year maps should be referenced for understanding general growth patterns across Castle Pines and the surrounding area. It is important to note that TAZs are not consistent with jurisdictional boundaries. Therefore, some zones primarily located within Castle Pines may appear more heavily developed than they actually are as the populated portions of the zones are outside of municipal limits.



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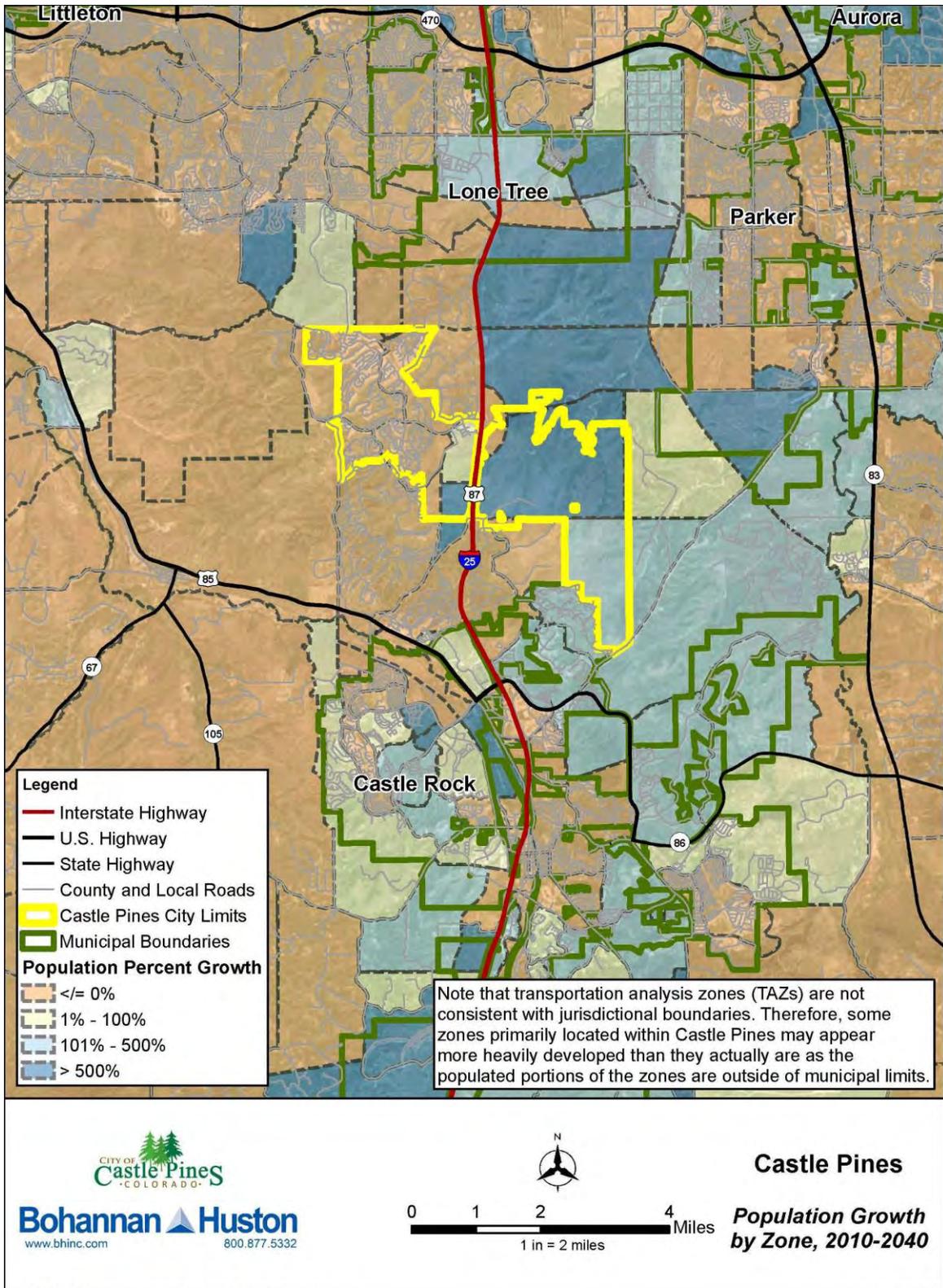
FIGURE 6 POPULATION BY ZONE, 2010



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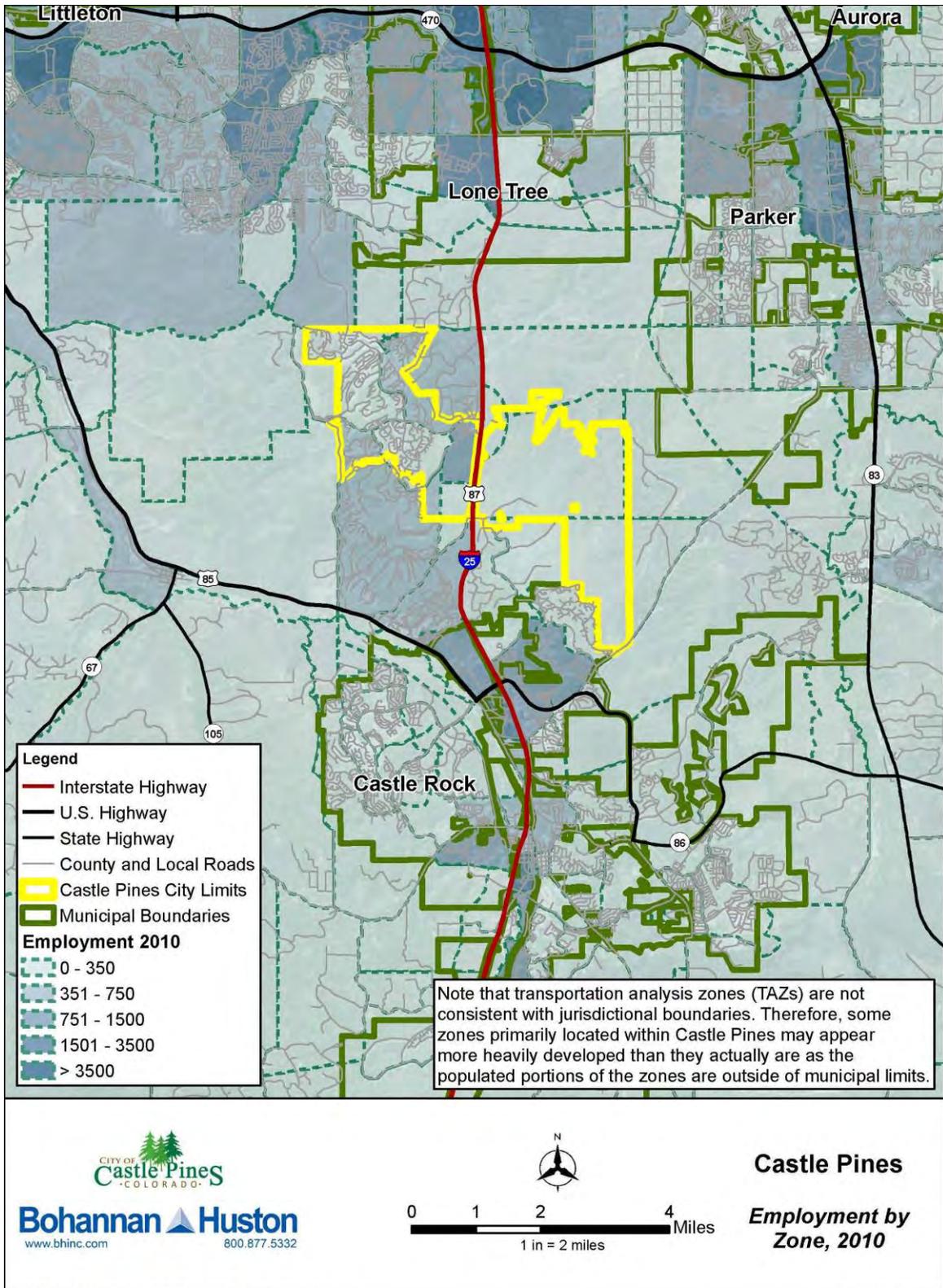
FIGURE 7 POPULATION BY ZONE, 2040



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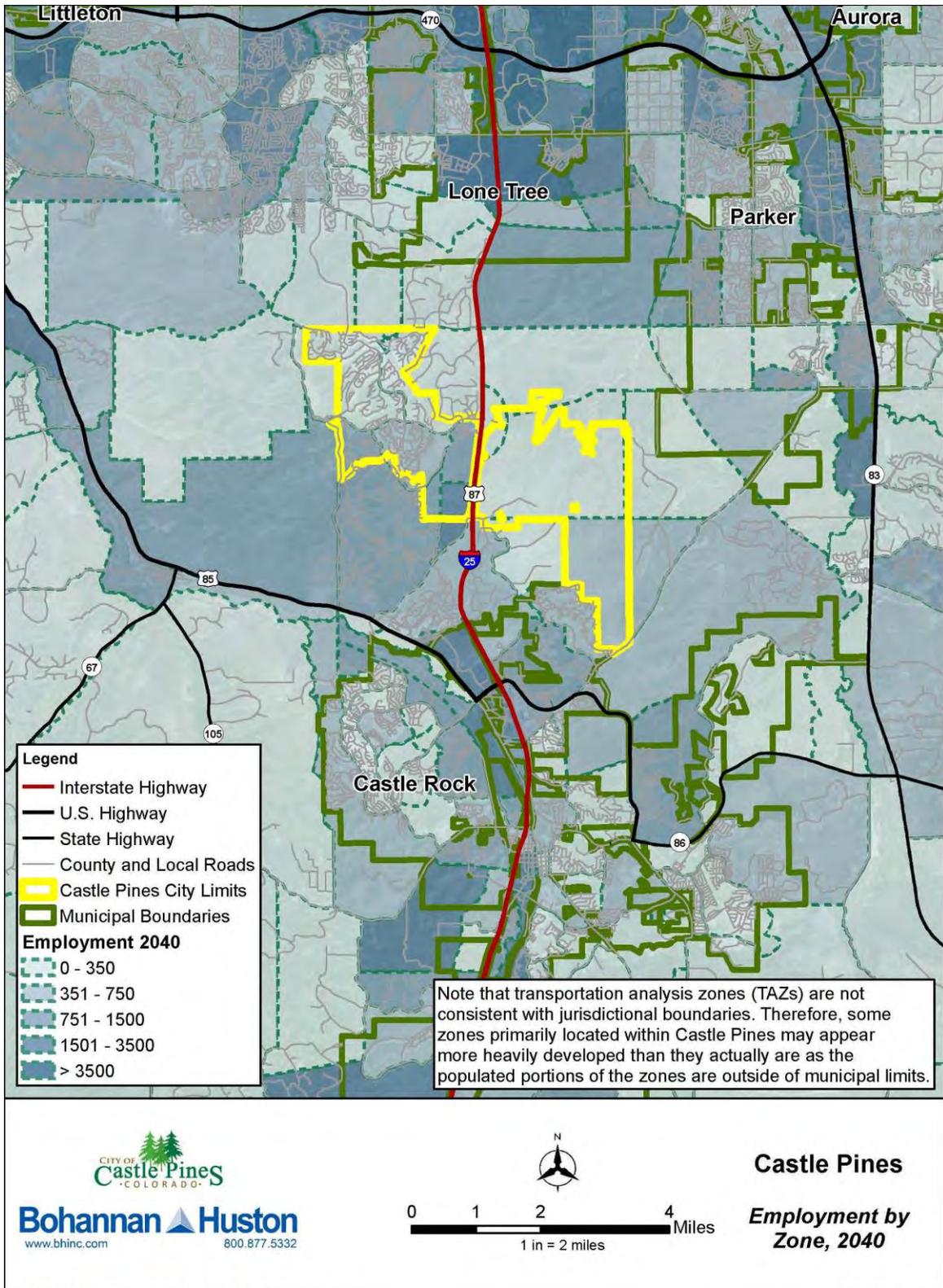
FIGURE 8 POPULATION GROWTH BY ZONE



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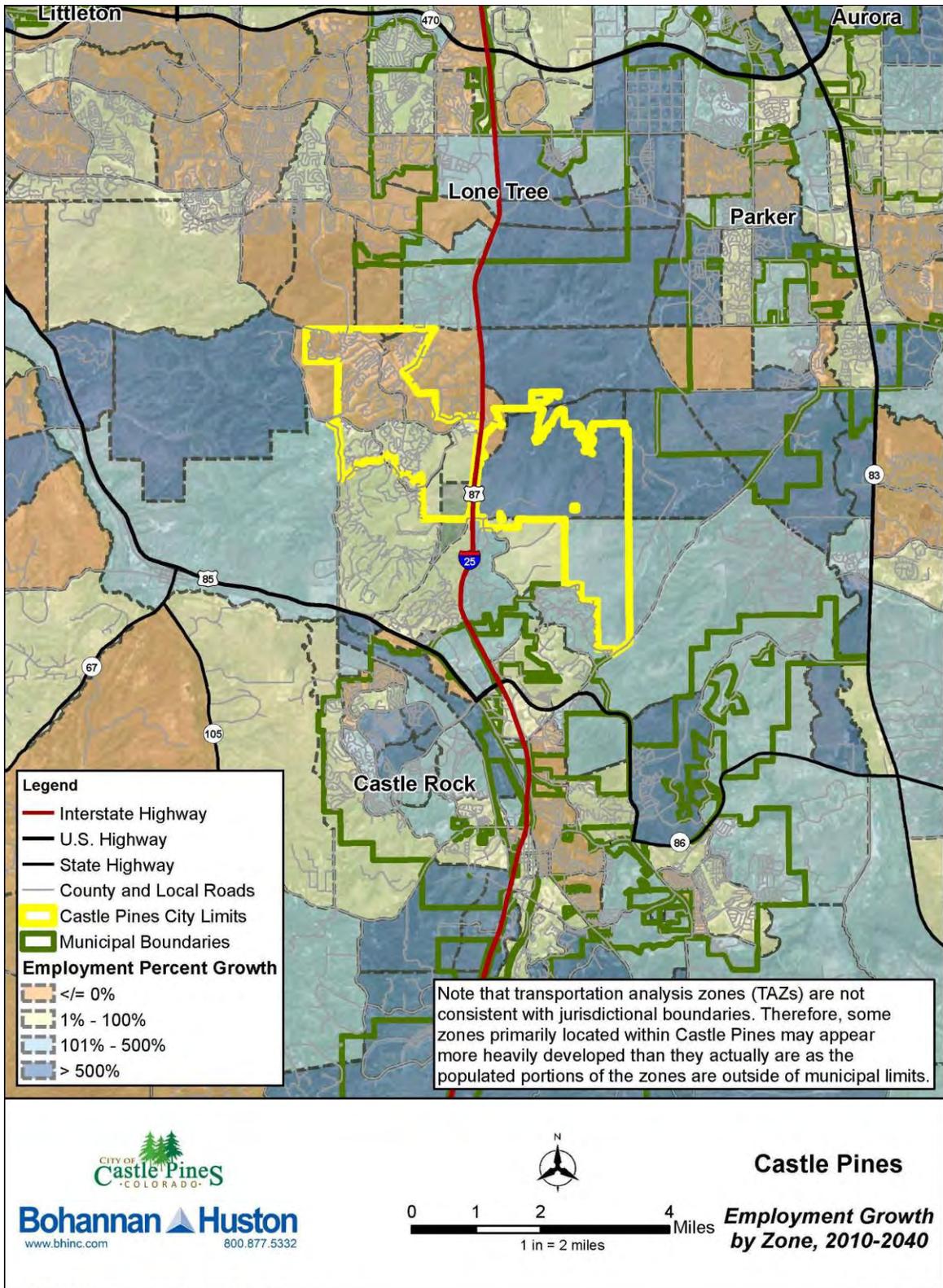
FIGURE 9 EMPLOYMENT BY ZONE, 2010



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FIGURE 10 EMPLOYMENT BY ZONE, 2040



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FIGURE 11 EMPLOYMENT GROWTH BY ZONE

Implications of Projections and Commuting Data

The projections indicate that lengthy commute times are likely to increase, and that Castle Pines will likely continue to export residents to external job sites and import workers for service and retail jobs.

In terms of local trips, residential growth east of I-25 may place increased importance on the Town Center area as a retail destination for a growing number of Castle Pines residents. To ensure that Castle Pines residents are able to shop locally, access to the Town Center area, travel along Castle Pines Pkwy, and across I-25 become especially critical.

The Lagae Ranch and Town Center developments each include hundreds of multi-family housing units. This housing type, mixed with the current housing patterns, which appeal largely to families with children and high-income professionals, begins to expand and address Castle Pines housing market and evolving housing demands. Currently, an over-abundance of a single-family type of housing can affect commuting patterns and create a reliance on single-occupancy vehicle travel, thus limiting the effectiveness of potential transportation investments undertaken by the City of Castle Pines. This movement toward incorporating more multi-family housing will only make Castle Pines more adaptive and more resilient to future changes in the housing and transportation realm.

Since the majority of employed residents in Castle Pines commute to work, transportation investments should support regional travel needs including improved roadway connections to regional arterial roadways. The development of a regional bicycle network would provide the opportunity for Castle Pines residents to better access sites outside of the community. Establishing and expanding public transportation opportunities for Castle Pines residents and workers could also be considered. Over the long-term, Castle Pines may also wish to coordinate with transit providers and create opportunities to access the rest of the metropolitan area without a private vehicle. Shuttle services and park and ride transit stations may help connect with the regional transit system.

Regional bicycle networks and expanded public transportation facilities would also be valuable to those who commute from within Castle Pines as well as other areas to work in the service sector in Castle Pines.

EXISTING TRANSPORTATION NETWORK

Roadways

The major roadways in Castle Pines include two arterials that intersect in the center of the city, Castle Pines Pkwy and Monarch Boulevard (Blvd). I-25 is a major interstate that bisects the city and provides north-south connections for residents to reach employment sites and services across the region.

The only existing roadway within Castle Pines providing east-west connectivity is Castle Pines Pkwy, and few roads offer north-south connectivity. Monarch Blvd connects both the north and south areas of the city, and continues northbound toward Highlands Ranch. Castle Pines Pkwy and Monarch Blvd are frequently intersected by local roads that provide access to residential neighborhoods.

Castle Pines residents can access several nearby communities by I-25 and through the network of collector roadways. Monarch Blvd and Daniels Park Road (Rd) lead to the Lone Tree and Highlands Ranch communities north of Castle Pines. Though not primary routes used by the traveling public, Daniels Park Rd and Lagae Rd/Country Club Drive (Dr) provide access south of Castle Pines to Castle Rock and Hess Rd connects Castle Pines to Parker. New roadways associated with the Lagae Ranch development and Town Center will also provide additional north-south connectivity upon completion.



CASTLE PINES RESIDENTIAL STREET



CASTLE PINES ROADWAY



CASTLE PINES RESIDENTIAL STREET

According to data collected by DRCOG from 2013 to 2015, the highest volumes of traffic within the city are located along Castle Pines Pkwy near I-25, with more than 27,000 vehicles per day; the segment of Monarch Blvd to the north of Castle Pines Pkwy carries more than 10,000 vehicles per day. See Figure 13 on Average Annual Daily Traffic (AADT) for more information on the distribution of vehicle trips across Castle Pines.

Figures 12-16 represent current roadway conditions in the City of Castle Pines.

- **Figure 12:** Castle Pines Roadway Network – Depicts roads within Castle Pines by functional class. Higher class facilities (i.e. arterials) provide greater mobility across the City but limited access to individual sites. Local roads provide greater land access, but are designed for shorter trips at slower speeds.
- **Figure 13:** Average Annual Daily Traffic (AADT) – DRCOG collects 24-hour traffic volume data on collector and arterial roads across the Denver metropolitan area. Data for Castle Pines Pkwy and Monarch Blvd were collected between 2013 and 2015.
- **Figure 14:** AM Peak Hour Volume-to-Capacity Ratios
- **Figure 15:** Off Peak Hour Volume-to-Capacity Ratios
- **Figure 16:** PM Peak Hour Volume-to-Capacity Ratios

Figures 13-16 depict the level of traffic volume (i.e. demand) during a particular period of the day, relative to the roadway capacity (i.e. supply of roadway space). As volume-to-capacity (V/C) ratios approach or surpass 1.0, a roadway is considered to be near or at capacity and likely experiences congested conditions during certain parts of the day. The peak hours are defined as the continuous 60-minute stretch of time with the highest traffic volume for each peak period. The off-peak period refers to the time in the middle of the day between the morning and evening peak commuting periods.

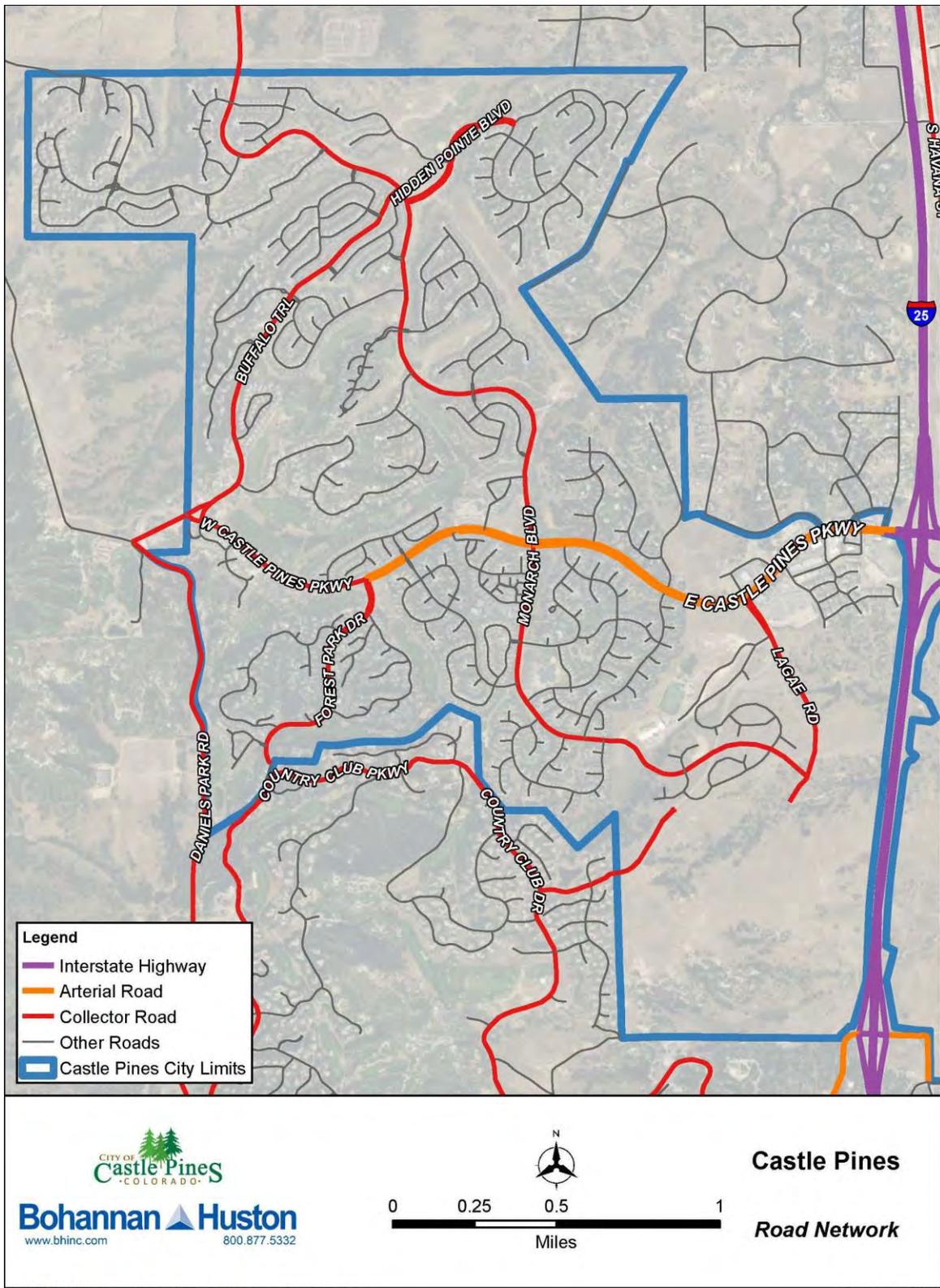


FIGURE 12 CASTLE PINES ROADWAY NETWORK

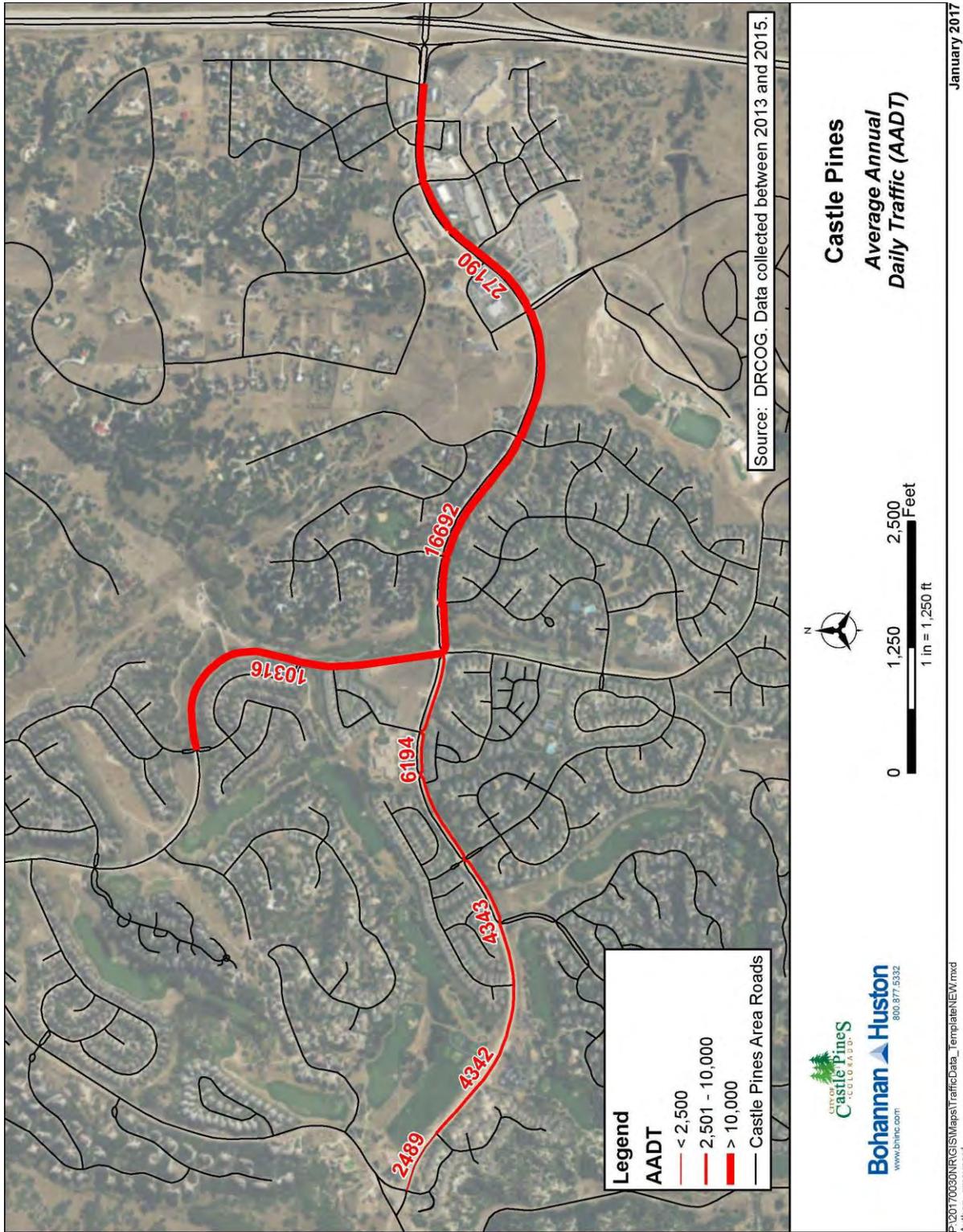


FIGURE 13 AVERAGE ANNUAL DAILY TRAFFIC

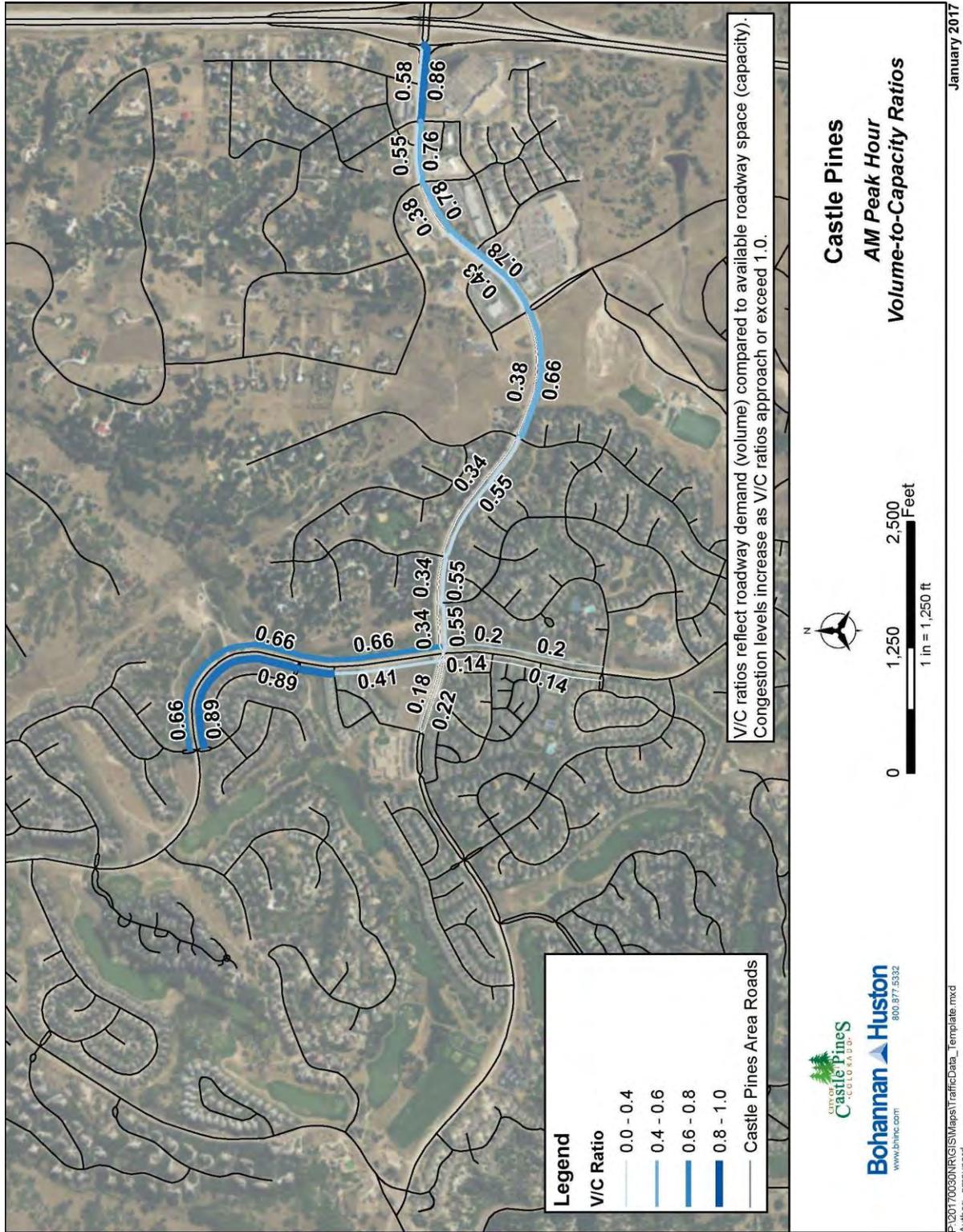


FIGURE 14 AM PEAK HOUR VOLUME-TO-CAPACITY RATIOS

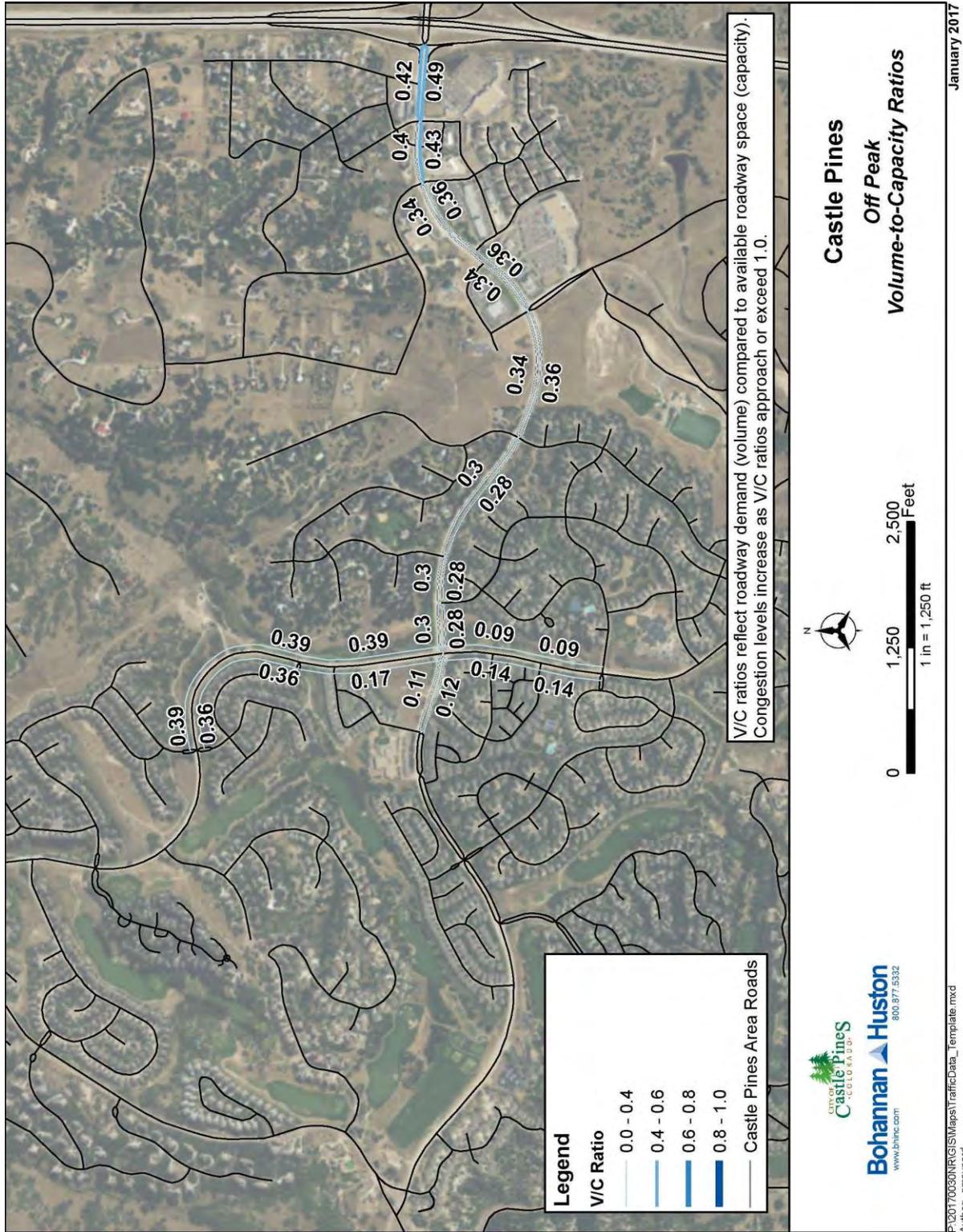


FIGURE 15 OFF PEAK HOUR VOLUME-TO-CAPACITY RATIOS

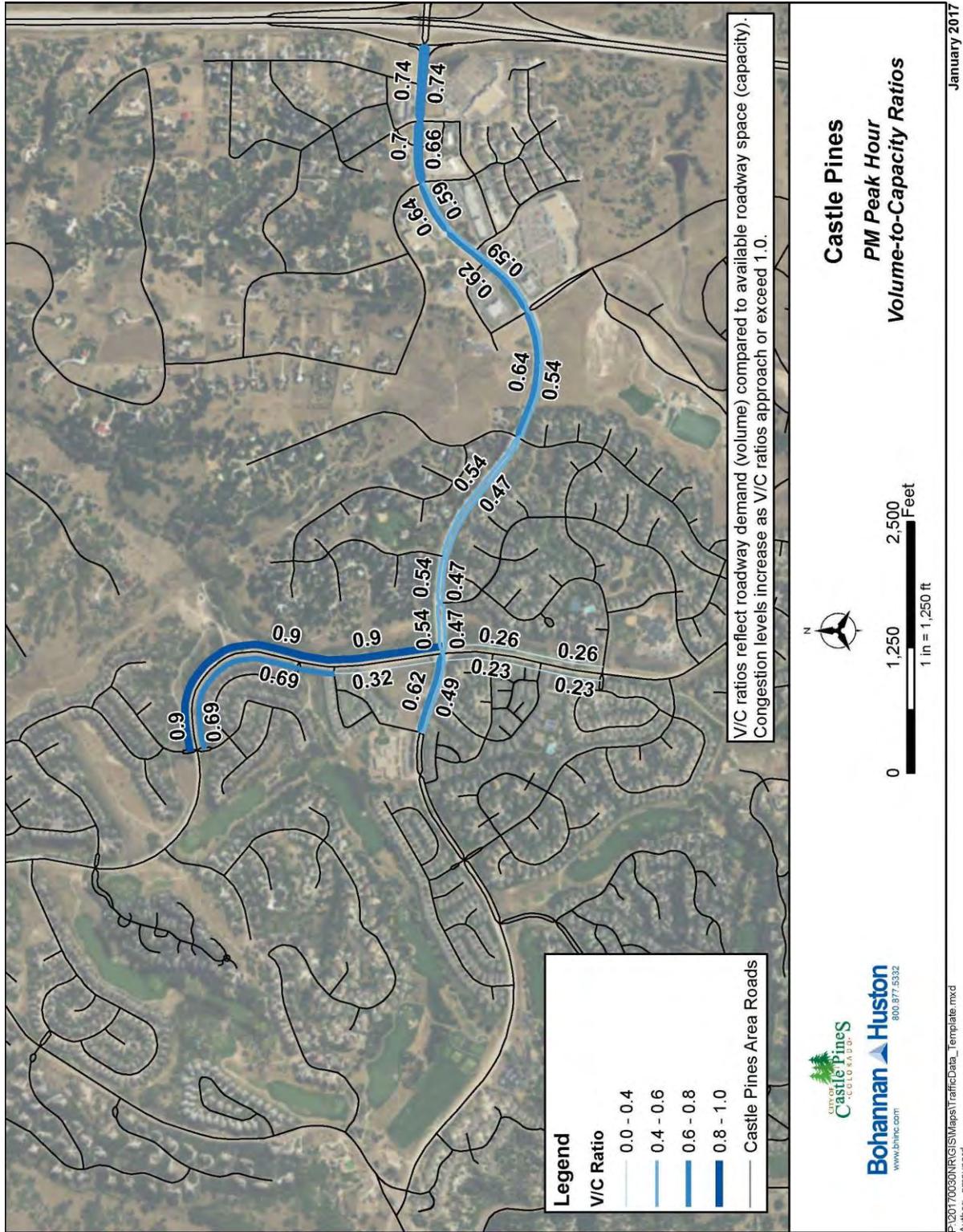


FIGURE 16 PM PEAK HOUR VOLUME-TO-CAPACITY RATIOS

As a community that has a significant amount of employed residents leaving the city for work, Castle Pines experiences a directional split in which higher levels of traffic are observed approaching I-25 in the AM peak period, and moving westbound from I-25 in the PM peak period. This can be observed in the directional V/C values by peak period on Castle Pines Pkwy and Monarch Blvd; in the AM peak, Castle Pines experiences traffic volumes in the eastbound direction that approach capacity at the I-25 interchange.⁵ Traffic patterns are also influenced by the presence of multiple schools along Castle Pines Pkwy, which generate additional non-commuting trips during the AM peak period in particular as parents take their children to school.

Although there is a marked increase in V/C ratios in the peak travel directions during the peak periods, major roads in Castle Pines operate under capacity, indicating that congestion is the result of traffic operations, bottlenecks, or conflicts with turning movements, rather than insufficient roadway space. The highest V/C ratios for any time of day are observed on Monarch Blvd in the PM period. However, Monarch Blvd performs well due to the smaller number of access points and adequate turn bays.

On-Street Bicycle Facilities

On-street bicycle lanes are often used for longer-distance trips and for higher speed commuting purposes, in contrast to the trail network which supports low-speed recreational trips and access to parks and open space.⁶ Castle Pines is steadily expanding its on-street bicycle network through a combination of marked bicycle lanes and wide shoulders. Castle Pines Pkwy now features bicycle lanes between



CASTLE PINES TRAIL NETWORK CONNECTION

⁵ V/C ratios are a measure of recurring congestion that contrast the observed traffic volume (i.e. demand) along a roadway compared to the available capacity (i.e. supply of roadway space). The planning capacity values used in this analysis do not include turn lanes.

⁶ As a point of reference, the average bicycle trip to or from work in the United States is 21.2 minutes and the average trip length is 3.8 miles. The average bicycle trip for any purpose in the United States is 19.4 minutes and the average trip length is 2.3 miles. (Kuzmyak and Dill, "Walking and Bicycling in the United States," National Household Travel Survey, 2012)

Monarch Blvd and Lagae Rd, along with wide shoulders to the west of Monarch Blvd that support bicycling activity. Forest Park Dr offers marked on-street bicycle lanes as well. Multiple roads feature wide shoulders which function as on-street bicycle lanes, including Old Happy Canyon Rd/ Buffalo Trail and Monarch Blvd.

The 2015 Douglas County Bicycle Map identifies the entire length of Castle Pines Pkwy as a ‘bicycle route.’ Monarch Blvd and Buffalo Trail are also considered bicycle routes.⁷

Low volume residential roads are also appropriate for on-street bicycling and can provide important connections between residential areas and the Castle Pines trails network or formal bicycle lanes. However, the prevalence of cul-de-sacs and limited connectivity can limit the ability of Castle Pines residents to complete local trips by bicycle.

Pedestrians and Sidewalk Infrastructure

Sidewalk infrastructure in Castle Pines is often limited to the internal networks within residential neighborhoods and along some major corridors. Sidewalks along major



CASTLE PINES SIDEWALK

roadways are often only located on one side of the street and connections to local streets and safe crossings are often lacking. Improvements to the pedestrian network have been recommended by the Comprehensive Plan and the Multi-Modal Enhancement Plan, including connectivity between neighborhoods and shopping areas and schools.

The Comprehensive Plan and the Multi-Modal Enhancement Plan also recommend enhanced crossings to create safer pedestrian accessibility at major intersections. Pedestrian crossings are not consistent on roadways throughout Castle Pines, with the majority of complete

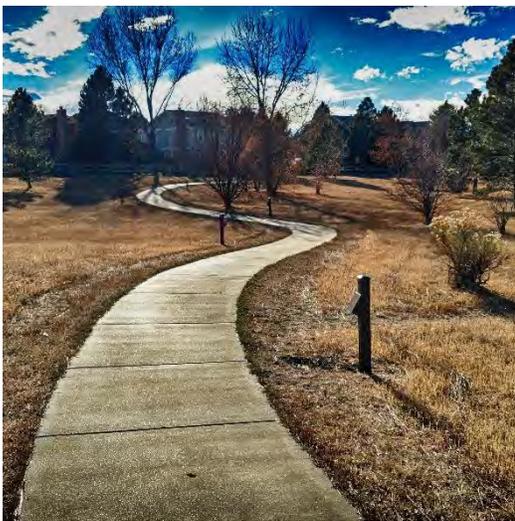
⁷ According to this map, on-street bicycle lanes and off-street multi-use paths do not exist in Castle Pines.

crossings located near schools. Pedestrian infrastructure should include landscaped medians and crossings which connect with sidewalks to enhance ADA accessibility.

Commercial and retail centers near I-25 and Castle Pines Pkwy also lack internal pedestrian connections. Where sidewalks do exist, they are often only on one side of the road or do not extend beyond parking lot access. These conditions often require shoppers to drive between stores because it is the only safe option. Although the retail center is privately owned, the recommendations in this plan can potentially encourage improvements to be made over time or when changes in land use or ownerships occur.

Off-Street Trail Network

The off-street trail system in Castle Pines is owned and managed by the Castle Pines North Metropolitan District. Approximately 14 miles of trails navigate through open space, private development, and residential neighborhoods. The types of uses supported by the trail network in Castle Pines include bicycles, pedestrians, and other non-motorized activities. According to the PaRC Plan, trails are placed within open space facilities that are separated from roadways. The trail system was created this way with the intention to minimize conflicts with motorized vehicles and maintain the recreational feel of the area. Because the trail network is distanced from the roadway, it functions as a substitute for sidewalks in many locations.



OFF-STREET TRAIL



MONARCH BLVD AND TENBY WAY

A common characteristic of the trail system throughout Castle Pines is its narrow width and navigation of steep slopes. The Trail Design Criteria found in the PaRC Plan recommends two-way shared-use trails to be 10-12 feet wide with the minimum allowable width being 8 feet. The majority of off-street trails in Castle Pines are approximately 8 feet in width.

There is a lack of city-wide connectivity and site access in the current trail network. An example of this is at the intersection of Tenby Way and Monarch Blvd, where trails converge but adequate sidewalks or crossings are missing. Due to the insufficient trail connectivity and the narrow width of the trails, Castle Pines residents may not be able to use the system to commute or effectively reach local retail destinations by bicycle.

Transit

The nearest transit network is located in the City of Lone Tree, approximately 4 miles north of Castle Pines, where the Regional Transit District (RTD) offers a regional light rail connection at Lincoln Station.⁸ The RTD operates bus services and other on-demand and special event services across the Denver metro area. Castle Pines is not a member of the RTD and transit services are not currently available within city limits.



RTD LINCOLN STATION IN LONE TREE

It is clear that residents of Castle Pines primarily commute to work by single occupancy vehicles; however, the approximately 1% who use public transit for commuting purposes most likely drive to the nearest park and ride facility located at Lincoln Station, just over five miles north of Castle Pines.

For more details on RTD light rail expansion see the Transportation Initiatives and Regional Coordination section.

⁸ Image credit: <https://www.flickr.com/photos/davidwilson1949/25741033555/in/photostream/>

Overall Goals of the Castle Pines Comprehensive Plan

- Serves as an **advisory document for guidance for zoning actions**, subdivision regulations, land use map and annexation decisions.
- Will serve as **basis for community programs and decision-making** for capital budget recommendations, community development, school siting, recreation or open space land acquisition and housing.
- Will serve as a **standard for review** at the County and State levels. Master Plans are key documents used to **aid in the development of regional plans**, or specific plans such as transportation plans and economic development plans.
- Will serve as a long-term **guide for review of public and private proposed plans** that may affect the physical, social, and economic settings of the Castle Pines Community.
- The Plan serves as a guide to preserve public health, safety, and welfare of the community. By having an effective Comprehensive Plan in place, orderly development of land within the City's jurisdiction will take place.

TRANSPORTATION INITIATIVES & REGIONAL COORDINATION

The Castle Pines Master Transportation Plan builds upon existing planning efforts to consider how best to meet previously identified local needs. The visions and goals of each of these plans and initiatives are considered in the Master Transportation Plan with the intent that the more that implementation strategies and objectives align, the more sustainable and beneficial the transportation system will be for the residents of Castle Pines.

The plan also considers projects and priorities contained in other documents. Transportation networks do not work well in isolation, and it is important to Castle Pines decision-makers to understand and coordinate with other regional and local planning efforts. A summary of approved plans and policies is provided below with the areas of connection identified for each plan.

Castle Pines Comprehensive Plan

The Castle Pines Comprehensive Plan defines the overall vision for the community, including the desired development and land use patterns, and the policies and programs that can help the city achieve its goals. The transportation-related goals and objectives are expanded upon in the Master Transportation Plan.

The Comprehensive Plan also contains a series of implementation strategies that discuss how the transportation system can support development objectives, such as local retail, while enhancing the unique residential character of the community. Relevant **implementation items include** create walkable mixed-use areas, expand the trail system to connect commercial and recreation destinations to neighborhoods, improve the streetscape

and traffic flow, and anticipate future transit expansion. Perhaps most critically, transportation-related investments should “Build on Current Look, Feel, and Brand of Castle Pines” (Comprehensive Plan, p. 71). The implementation items are directly reflected in the goals and objectives of the Master Transportation Plan.

Community Vision

The Community Vision outlined in the Comprehensive Plan is articulated for five particular areas: parks, recreation, and amenities; economic development; housing; transportation; and land use and growth management. Although there are transportation-specific items in the Community Vision, infrastructure investments play a critical role in achieving each of these elements.

Parks, Recreation, and Amenities that encompass new recreational facilities, a variety of park types, natural areas, high quality schools, and regional recreational amenities through an integrated city-wide network of open space, greenways, parks, and trails that are accessible to all residents of the City.

Economic Development that reinforces, expands, and develops our unique and connected town centers as vibrant community gathering spaces with a range of distinct businesses and restaurants, event space, entertainment venues, mixed-use development, civic amenities, enhanced walkability, quality design and a supportive mix of housing.

Housing that builds on our friendly, small-town feel and provides high-quality housing for all lifecycles, integrated into great neighborhoods and set in a natural setting while providing opportunity for new types of housing in close proximity to our walkable town centers.

Transportation that facilitates a safe and connected community through off-street and on-street pathways, a highly connected road system, new transportation options, and unique gateway features, streetscape improvements, and signage that represents the community’s unique character.

Land Use and Growth Management that provides a quality-of-life community with exceptional design, augmented by extensive access to open space and physical separation from adjacent communities which together support a healthy, aesthetically pleasing, and cohesive community.

Connection between Comprehensive Plan and Master Transportation Plan

Development of the Castle Pines Comprehensive Plan was facilitated through a multi-phase community engagement process. This process included stakeholder and small group interviews, public workshops, online participation opportunities, and open house events. Community members and stakeholders were encouraged to discuss “key opportunities that would guide future investment, City regulations, infrastructure improvements and the mix of land uses within the City.”⁹ This thorough public outreach effort resulted in the development of goals and objectives that are representative of the community’s interests and priorities.

As the adopted guiding vision for the City of Castle Pines, the Comprehensive Plan foundation serves as the foundation for subsequent planning efforts including the Master Transportation Plan. In short, the Comprehensive Plan identifies local issues and priorities, and the Master Transportation Plan puts those priorities into action.

The Master Transportation Plan developed its goals and objectives based on those already established and approved in the Comprehensive Plan. During the goals and objectives development process for this plan, transportation-related goals from the Comprehensive Plan were separated into distinct concepts that were used to form issue-specific goals. Additionally, transportation-related objectives from the Comprehensive Plan were simplified and supplemented with transportation needs specific to this plan. See Appendix C for more information on the goals and objectives.

TABLE 2 IMPLEMENTATION OF COMPREHENSIVE PLAN GOALS AND OBJECTIVES

Master Transportation Plan Goal	Comprehensive Plan Citation	Implementation Measure
1. Develop a safe, efficient, multi-functional transportation network designed to promote connections to local destinations	Comprehensive Plan Goal T-2: “Develop an efficient, multifunctional transportation network designed to ensure safety and promote user access ”	Blueprint Process and roadway design guidance require examination of network connectivity, access to local destinations, and consideration of multi-modal transportation infrastructure.
2. Facilitate cost-effective operations and roadway	Comprehensive Plan Goal T-2: “Facilitate cost-	Policy recommendations supporting access management; consideration of transportation systems

⁹ Castle Pines Comprehensive Plan, p. 9

<p>maintenance strategies</p>	<p>effective operations and maintenance”</p>	<p>management strategies in Blueprint Process.</p>
<p>3. Develop bicycle infrastructure network to support increased commuting trips and serve the needs of all types of cyclists</p>	<p>Multiple objectives under the Comprehensive Plan Goal T-3: “Increase pedestrian and bicycle connectivity, accessibility, safety, and comfort”</p>	<p>Guidance on bicycle infrastructure design characteristics; consideration of bicycle infrastructure provision in Blueprint Process.</p>
<p>4. Increase pedestrian connectivity, accessibility, safety, and comfort</p>	<p>Multiple objectives under the Comprehensive Plan Goal T-3: “Increase pedestrian and bicycle connectivity, accessibility, safety, and comfort”</p>	<p>Guidance on sidewalks, pedestrian crossings, general connectivity; consideration of pedestrian infrastructure provision in Blueprint Process.</p>
<p>5. Facilitate future opportunities for Castle Pines residents to access regional destinations via public transit</p>	<p>Comprehensive Plan Goal T-4: “Position the community for future public transit connections and commuting alternatives that reduce traffic congestion”</p>	<p>Policy recommendations supporting participation in regional transit and planning initiatives.</p>
<p>6. Develop transportation infrastructure that supports mixed-use development and walkable retail centers</p>	<p>Multiple objectives under Comprehensive Plan Goal T-2: “Develop an efficient, multi-functional transportation network designed to ensure safety, promote user access, and facilitate cost-effective operations and maintenance” Goal T-4: “Position the community for future public transit connections and commuting alternatives that reduce traffic congestion”</p>	<p>Policy recommendations supporting Complete Streets initiatives; roadway design guidance that supports multi-modal infrastructure in mixed-use areas and locations with high levels of pedestrian activity.</p>

Recreational Trail Design Standards

- “Frequent access points from the local road network including culs-de-sac.
- Direct connections from neighborhoods to parks.
- Directional signs to direct users to and from the path.
- A limited number of at-grade crossings with streets or driveways (except sidepaths).
- Terminating the path where it is easily accessible to and from the street system.
- Separate treads for pedestrians and bicycles when heavy use is expected. With heavy volumes, a separate soft-surface track (5-foot minimum) for exclusive pedestrian or jogging use is encouraged.
- Amenities such as dark-sky lighting, interpretive signage, and wildlife-friendly fencing (where appropriate.”

Source: PaRC Plan

Parks and Recreation Comprehensive Plan

The Castle Pines Parks and Recreation Comprehensive Plan (PaRC Plan) reinforces the vision established in the Castle Pines Comprehensive Plan as a community that values scenic beauty and active lifestyles through a system of well-connected parks and open spaces.

The plan gathered input on the types of recreational services desired by community residents and developed an action plan for future projects. According to the PaRC Plan, Castle Pines residents desire a city-wide network of parks, trails, and open space that is universally accessible by all members of the community. Residents also attribute their quality of life to the presence of these recreational activities.

The PaRC Plan identified the need to increase accessibility to parks and trails from residential areas in Castle Pines. Due to the number of cul-de-sacs and internally oriented roadway networks within residential neighborhoods, residents are not able to easily access nearby parks and trails. According to the PaRC Plan, it is not likely that this can be remedied in developed areas, which is why accessibility needs to be addressed during the subdivision platting process in areas of Castle Pines that are undeveloped. The following table is the current design criteria for trail development provided by the PaRC Plan.

TABLE 3 TRAIL DESIGN CRITERIA

Design Criteria	Description
Width	<ul style="list-style-type: none"> 8 feet is the minimum allowed for a two-way shared-use path and is only recommended for low-traffic situations. 10 feet is recommended in most situations 12 feet is recommended for heavy-use situations with high concentrations of multiple users.
Lateral Clearance	<ul style="list-style-type: none"> A 2-foot or greater shoulder on both sides of the path should be provided. An additional foot of lateral clearance (total of 3 feet) is required by the Manual on Uniform Traffic Control Devices for the installation of signage or other furnishings.
Overhead Clearance	<ul style="list-style-type: none"> Clearance to overhead obstructions should be 8 feet minimum, with 10 feet recommended.
Striping	<ul style="list-style-type: none"> When striping is required, use a 4-inch dashed yellow centerline stripe with 4-inch solid white edge lines. Solid centerlines can be provided on tight or blind corners and on the approaches to roadway crossings.
Materials and Maintenance	<ul style="list-style-type: none"> The use of concrete for paths has proven to be more durable than asphalt over the long term. Saw-cut rather than troweled concrete joints improve the experience for trail users.
Additional References and Guidelines	<ul style="list-style-type: none"> AASHTO. Guide for the Development of Bicycle Facilities. 2012. NACTO. Urban Bikeway Design Guide. See entry on Raised Protected bike lanes. 2012.

SOURCE: PARC PLAN

Multi-Modal Enhancement Plan

The Multi-Modal Enhancement Plan evaluates the transportation infrastructure along Castle Pines Pkwy and Monarch Blvd and provides guidance for how to meet the needs of all roadway users. The plan identifies improvements needed to safely accommodate multi-modal travel by:

1. Managing vehicular speeds
2. Reducing vehicle-pedestrian and vehicle-bicycle conflicts
3. Improving facilities to safely and efficiently accommodate multiple types of users

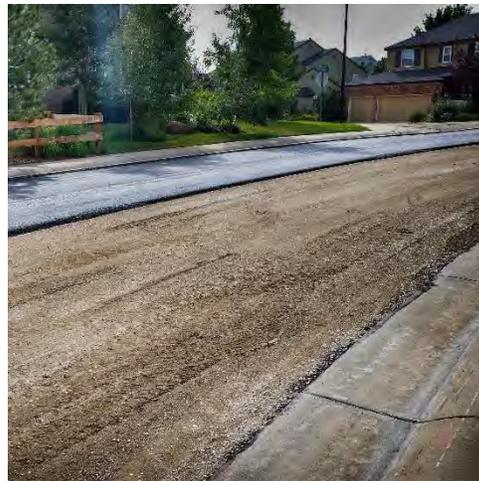
The plan prioritizes improvements that are low-cost, will provide safe facilities, and that respond to citizen concerns. Specific recommendations include concrete rehabilitation measures at intersections, pedestrian refuge improvements in medians with patterned

crosswalks, rectangular rapid fire beacons, school access improvements to American Academy and DSC Montessori, and roundabouts where appropriate.

Pavement Management Plan

The Pavement Management Plan documents “the implementation of a comprehensive pavement management program for the City of Castle Pines.” The plan “identifies the current condition of the pavement, evaluates maintenance strategies, and establishes budgets versus predicted pavement condition.”

According to the PAVER database, pavement condition index (PCI) values should not fall below 55-65 because the cost to rehabilitate pavement in poor condition increases exponentially. As of 2016, the average PCI value for Castle Pines roadways is 75. The goal is to keep the pavement maintained so additional funds are not unnecessarily spent on the rehabilitation of pavement in poor condition. Figure 17 demonstrates the average city-wide PCI score over time.¹⁰



PAVING PROJECT AT SUGARFOOT ST AND HARLAND PLACE

The plan determined that it would take a budget of approximately \$1.5 million per year for major maintenance and rehabilitation to maintain the pavement condition at the current level. The plan also advises that an additional fixed budget for preventative and stop gap maintenance be set up annually. The estimated cost for preventative maintenance needs is \$1.25 million, as of the 2014 inspection.

In practice, roadway maintenance expenditures for the City of Castle Pines have been greater than anticipated, and the share of the budget allocated for roadway maintenance has gone up over time. In addition, many City-owned roads were constructed more than three decades ago and will require more substantial reconstruction in the coming years. As a result, Castle Pines faces challenges in meeting expectations of residents in terms of the quality of local roads.

¹⁰ This figure is based on City data and is not contained in the Pavement Management Plan.

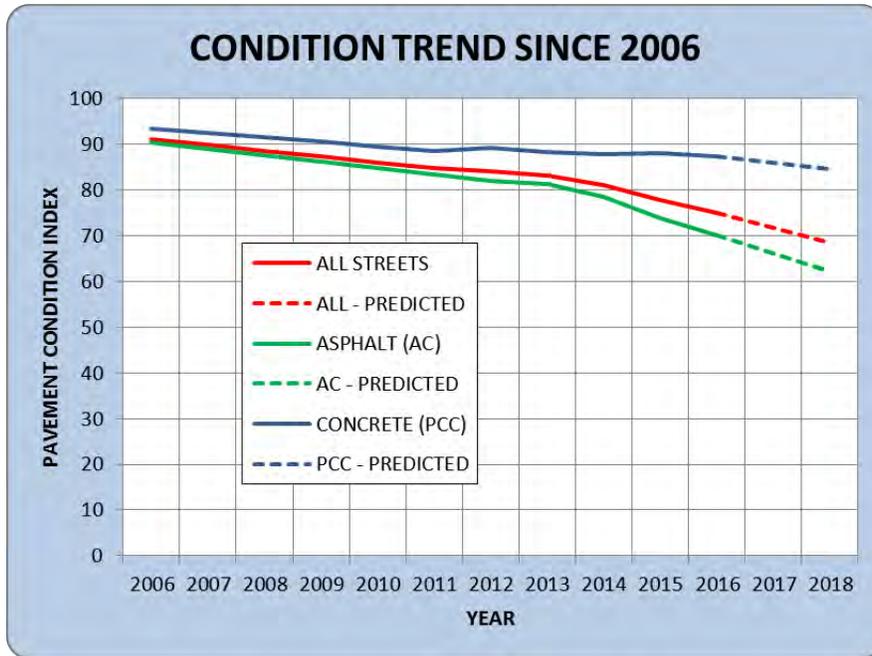


FIGURE 17 PCI LEVEL OVER TIME¹¹

The Canyons/East Castle Pines

The Canyons development is a 3,343-acre master planned community located east of I-25 between Hess Rd and Happy Canyon Rd. The area is slated for 2,500 single and multi-family housing units in addition to acreage for public parks and open space, civic uses, commercial and retail, and more.¹² The mixed-use development is intended to allow residents to more easily work, shop, and play within the community. It is also anticipated that public transportation connections will be considered, which could provide regional connectivity to major employment centers throughout the Denver metropolitan area.



FIGURE 18 THE CANYONS DEVELOPMENT

¹¹ Source: Borstad Consulting Services, LLC

¹² Source: <http://www.castlepinesgov.com/canyons>, Image Credit: The Castle Pines Connection

DRCOG Metro Vision Regional Transportation Plan

The Denver Regional Council of Governments (DRCOG) is a public planning organization that works with an association of local governments across the Denver region, including Douglas County. DRCOG is responsible for addressing regional planning challenges by establishing policies to best guide growth, development, and transportation. The City of Castle Pines became a member of DRCOG in January 2017.

DRCOG produces a Metro Vision Plan, the long-range plan for growth and development across the Denver Metropolitan Area. The current Metro Vision plan was adopted by the DRCOG Board of Directors in January 2017. The plan is complemented by the Regional Transportation Plan (RTP), which examines mobility issues and strategies. The RTP contains a fiscally constrained list of all transportation projects that can reasonably be expected to be completed by the Plan's 2040 horizon year (each update generally extends the horizon period five years into the future) under current and projected funding levels. DRCOG also facilitates the distribution of federal funds across the Denver metropolitan area through the Transportation Improvement Program.

DRCOG's regional planning efforts respond to the anticipated 40% population growth in the Denver metropolitan area and a substantial increase in vehicle miles traveled (VMT). A consequence of the increase in VMT is increased congestion along I-25. Although a number of improvements to I-25 are proposed, many parts of I-25 south of Downtown Denver are already congested, and travel conditions on I-25 are expected to deteriorate over time.

Regional Transportation Projects near Castle Pines

Regional growth patterns evaluated by the agency and transportation investments projects programmed through DRCOG impact the City of Castle Pines and its residents. There are a number of transportation projects that are identified for funding in the RTP.

The most noteworthy improvements for Castle Pines planning efforts are improvements sponsored by Douglas County to the east of I-25 that will facilitate growth in the Canyons planned development. In particular, Douglas County has

proposed improvements along Hess Rd from I-25 to Chambers Rd and the construction of Canyons Pkwy between Hess Rd and Crowfoot Valley Rd.

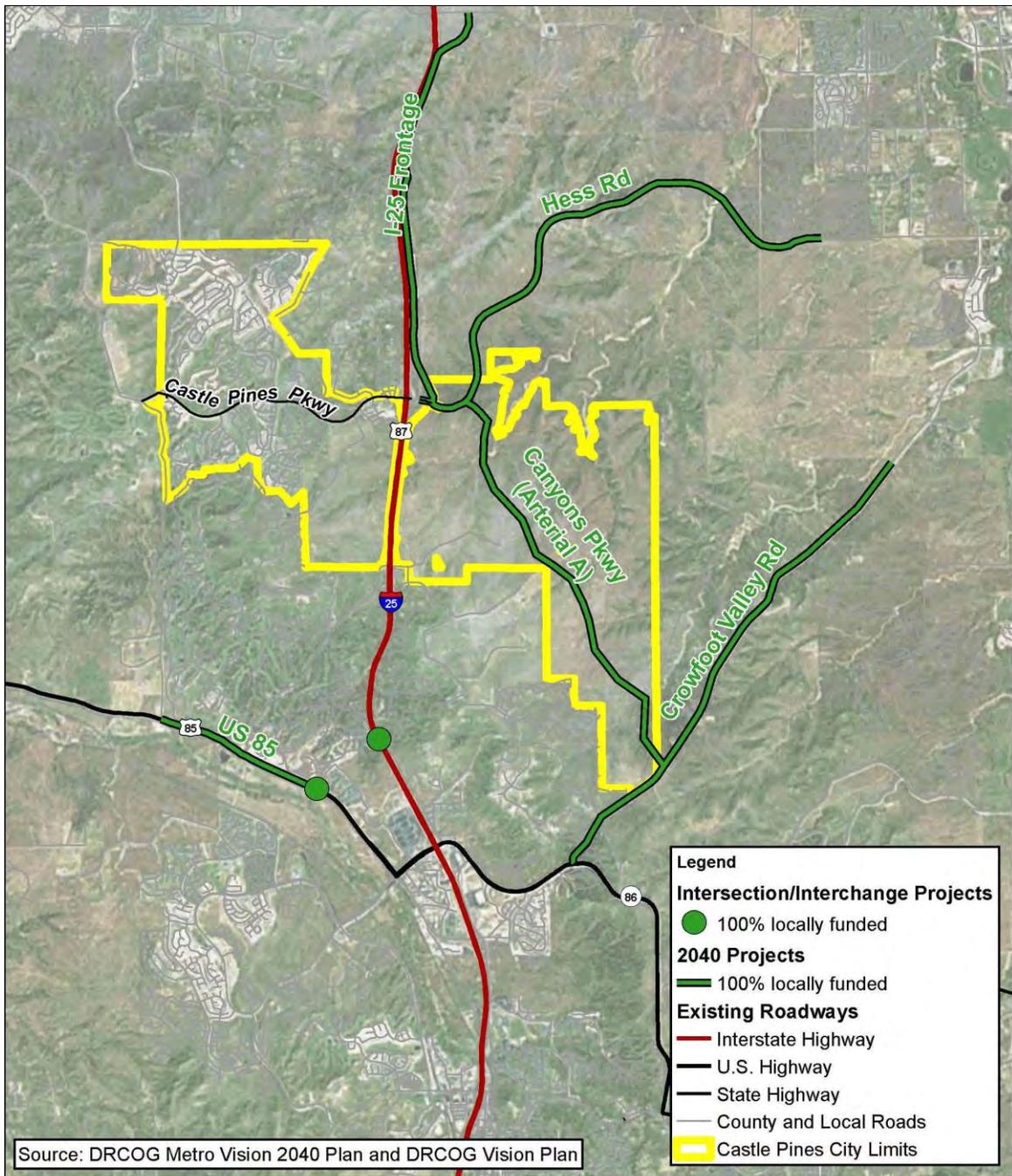
Table 4 also identifies projects in the DRCOG Vision Plan, which contains a long-term wish list of projects for which funding has not been identified and further planning is required. Future analysis may indicate these projects should be modified (or may be unwarranted).

Another regional transportation project that has potential to impact Castle Pines is the Planning and Environmental Linkages Study of I-25 from Monument to C-470. This study is evaluating the widening of I-25 as a means of alleviating weekday and weekend congestion from Colorado Springs to the Denver metro area. Environmental analysis is being accelerated and CDOT and Douglas County are pursuing funding options. CDOT is aiming to begin construction by summer 2019, with construction taking several years to complete. As funding has not yet been identified, the project is not currently included in the DRCOG list of projects for implementation.

TABLE 4 REGIONAL TRANSPORTATION PROJECTS NEAR CASTLE PINES¹³

Metro Vision 2040 Roadway Improvement Projects				
Agency	Location	Description	Funding	Timeframe
Douglas County	Canyons Pkwy (Arterial A): Crowfoot Valley Rd to Hess Rd	New Road	Local	2015-2024
CDOT	I-25: RidgeGate Pkwy to County Line Rd	Add through lanes	Regional	2015-2024
Douglas County	Crowfoot Valley Rd: Founders Pkwy to Macanta Rd	Add through lanes	Local	2025-2034
Douglas County	Crowfoot Valley Rd: Macanta Rd to Chambers Rd	Add through lanes	Local	2025-2034
Douglas County	Hess Rd: I-25 to Chambers Rd	Add through lanes	Local	2025-2034
CDOT	US 85: Meadows Pkwy to Louviers Ave	Add through Lanes	Regional	2025-2034
Douglas County	I-25 Frontage: Castlegate Dr	New Interchange	Local	2015-2024
Castle Rock	US 86: North Meadows Dr	New Interchange	Local	2015-2024

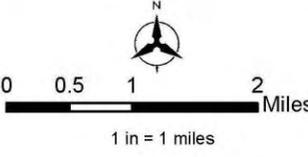
¹³ Source: DRCOG. The Vision Plan Transportation Projects are shown in this table because they exist in regional plans. However, the inclusion of the Monarch Blvd widening project is not necessarily supported by the community.





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Castle Pines

*Proposed
Transportation
Projects*

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 Author: gmaynard

FIGURE 19 PROPOSED TRANSPORTATION PROJECTS

Douglas County 2030 Transportation Plan Implementation Actions

Roadway:

- Sustainable funding sources to maintain roadway infrastructure
- **Detailed corridor studies** of four areas: NW Douglas County, C-470/ North-Central Douglas County, Lincoln/ Main-RidgeGate/ Hess Corridor, and I-25
- The inclusion of multi-modal elements into all **roadway standards**
- Practicing effective **access management** strategies to ensure roadways are safe and efficient
- **Intelligent Transportation System (ITS)** features including signal upgrades, signal system interconnects, improved signal maintenance, etc. and **Transportation System Management (TSM)** programs including auxiliary lanes, roundabouts, median modifications, etc.
- Update **codes, standards, and ordinances** to address multi-modal transportation opportunities

Douglas County Planning

Douglas County produces a Comprehensive Master Plan and a Transportation Plan that identify policy directions and provide guidance on transportation investments over the coming decades. Douglas County also produces Roadway Design and Construction Standards that guide the form and scale of roadway infrastructure. Until the development of the Castle Pines Master Transportation Plan, the Douglas County plans and design criteria have been the most locally-specific transportation policy documents, and have been utilized during roadway design.

The Douglas County 2030 Transportation Plan, adopted in 2009, prioritizes transportation networks that are safe, cost-effective, and that complement natural features and existing neighborhoods. The Plan also aims to support public transit initiatives and alternative transportation modes with the intent to improve living and environmental conditions for the residents of Douglas County.

The Transportation Plan identifies implementation actions to achieve a county-wide vision for roadway infrastructure, bicycle facilities, and transit services.

Roadway Vision Plan

The Roadway Vision Plan identifies roadways that will require improvements between the years 2010 and 2030 based on traffic generation resulting from regional development and increased growth. The form of these facilities is governed by the Douglas County Roadway Design and Construction Standards. Projects that have been identified in the Douglas County Roadway Vision Plan are generally included in the DRCOG Regional Transportation Plan.

Douglas County 2030 Transportation Plan Implementation Actions

Bicycle:

The implementation of the Bicycle Vision Plan aims to increase bicycle and pedestrian facilities and promote alternative transportation modes by developing a Bicycle Improvement Plan and a Bicycle Map.

Transit:

The implementation of the Transit Vision Plan involves the development of new transit services to operate along I-25. These routes would connect rural and urban areas and providing access to RTD services.

Bicycle Vision Plan

Improved options for cyclists are an identified priority for Douglas County. The Bicycle Vision Plan recommends expanding the existing bicycle system in phases to create a county-wide bicycle network to support recreational, commuting, and other bicycling trips. In particular, the plan calls for wide shoulders on County roads to support safe cycling conditions and identifies a priority network of roads that serve as critical connections for cyclists. Regional bicycle connections recommended in the plan are via Monarch Blvd, Daniels Park Rd, and Happy Canyon Rd.

Transit Vision Plan

The Transit Vision Plan guides the decision-making process for meeting anticipated transit needs across Douglas County. In particular, the Plan identifies the need for a transit services that provide connections between rural communities and urban areas. The Plan specifically identifies a specialized transit service that could operate on a fixed route from Parker to Castle Rock along I-25 two days per week. The same vehicle(s) could be utilized for demand response services throughout the County on the other three weekdays. The plan also proposes that a limited fixed route system operate during peak hour and mid-day along I-25 between Castle Rock and Lincoln Ave to provide a connection with RTD services and enable Castle Pines residents access via transit to job sites in Denver.

Douglas County Roadway Design and Construction Standards

Castle Pines currently utilizes the Douglas County Roadway Design and Construction Standards for dimensions of roadway elements and engineering criteria during roadway design. The Castle Pines Master Transportation Plan builds upon the Douglas County Roadway Design Standards by providing guidance on roadway elements and dimensions that support community objectives. See the Transportation Solutions section for more information.

Regional Transit District

The Regional Transportation District (RTD) is the regional public transit operating agency serving the greater Denver metropolitan area. RTD is overseen by a publicly-elected board of directors and provides services across eight counties, including parts of Douglas County. RTD is funded by a 1.0% gross receipts tax levied upon member jurisdictions and operates 130 bus routes, eight light rail lines, and more than 80 formal park and ride stations. The agency has pursued aggressive transit service expansion over the last decade. Castle Pines is not currently part of the RTD, though the neighboring communities of Lone Tree and Parker are members.

FasTracks Initiatives

FasTracks is a voter-approved transit expansion program which began in 2005 and is expected to be fully-completed in 2018. The program includes expanded commuter and light rail infrastructure, bus rapid transit services, park and ride facilities, and improvements to the overall public transit network to enhance regional connectivity and convenience.

The Southeast Rail Line currently extends 19 miles southbound from Union Station near I-25 and Broadway Blvd in Downtown Denver along I-25 to the Lincoln Station in Lone Tree, approximately 4 miles from the I-25 / Castle Pines Pkwy interchange. RTD is currently constructing an extension of this line to continue through Lone Tree. The Southeast Rail Extension began construction in the spring of 2016 and will extend current light rail facilities from the Lincoln Station to RidgeGate Pkwy. In addition to the 2.3-mile rail extension, there will be three new stations and a park and ride lot with 1,300 parking spaces.

The Southeast Rail Extension will provide increased opportunities for commuting residents of Castle Pines to utilize public transit to reach their places of work and other destinations across the Denver metropolitan area. However, no transit connections currently exist from Castle Pines to the station at RidgeGate Pkwy.

DRCOG Metro Vision Rapid Transit Plan

As part of the 2040 Metro Vision Regional Transportation Plan, DRCOG produced a Rapid Transit Plan that identifies current and under construction bus rapid transit and rail services operated by the RTD, as well as corridors where future expansion of the regional transit system may be pursued. The I-25 corridor south of Lone Tree toward Castle Rock is identified as a Tier 2 “Potential Regional and Intercity Corridor.” The designation reflects expansion opportunities, but further planning and funding would be required.

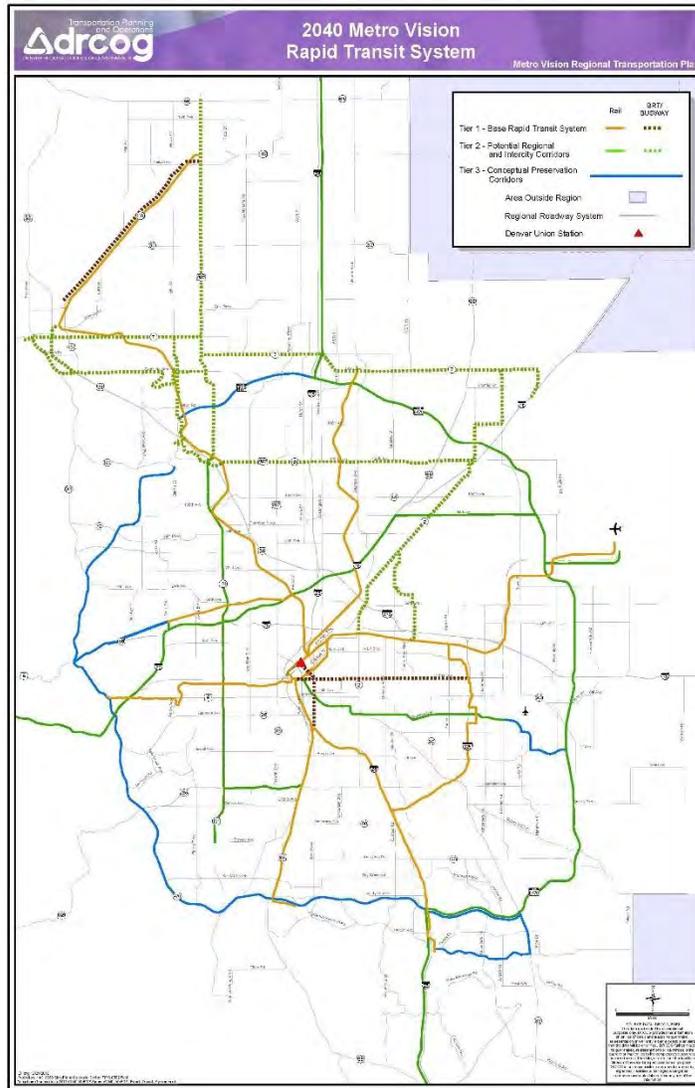


FIGURE 20 2040 METRO VISION RAPID TRANSIT SYSTEM

IMPLEMENTATION: BLUEPRINT PROCESS

The Blueprint Process is a means of diagnosing critical issues and guiding Castle Pines decision-makers towards the appropriate measures for a particular situation. Since infrastructure improvements are context and location-specific, it is not appropriate to apply a one size fits all approach. The Blueprint Process applies a common set of analyses and strategies to enable appropriate investment decisions to be made given the existing transportation infrastructure and the surrounding land use context.

A benefit of the Blueprint Process is the ability to analyze existing conditions and contrast those conditions against the desired infrastructure (e.g. the ideal roadway cross-section). In practice, the Blueprint Process contains a series of steps designed to aide city staff, local officials, contractors, private developers, and roadway designers during the development of transportation infrastructure improvement projects. The Blueprint Process is to be applied to Castle Pines-owned and maintained roadways, and complements the PaRC Plan, which provides direction on access to open space and recreational sites via the City's off-street trails network.

A working premise of the Blueprint Process is that roadways should play a larger role in the transportation network than just moving vehicles, and that improved on-street bicycle and pedestrian infrastructure should be provided where possible. In so doing, the Blueprint Process integrates the goals and objectives of the Castle Pines Master Transportation Plan into the analysis of potential transportation investments.

Major Issue Areas

The interpretation of the Blueprint Process and the identification of potential improvements depend on the issue(s) being addressed in any given location. In order to create an applicable process and to connect the Blueprint Process to the Master Transportation Plan's goals and objectives, four main issue areas have been identified and are addressed through the Blueprint Process:

- Community character
- Access and network connections
- Congestion management
- Bicycle and pedestrian

Issue Area: Community Character

Castle Pines is an emerging community that seeks to develop and maintain its residential character and ensure a high quality of life for its residents. Preserving community character is an overarching approach and a consideration that should take place as part of all transportation investments. In general, Castle Pines seeks transportation investments that support multi-modal travel options while ensuring adequate roadway infrastructure for trips into and out of the community. Therefore, Castle Pines must balance the need for efficient vehicle travel with roads that support other users and are of the appropriate scale.

There are two principal means of reinforcing community character and addressing the City's transportation goals and objectives.

1. Roadway design guidance
2. Community design features

Roadway design guidance ensures that roadways are constructed in a similar manner across the community, and that all transportation infrastructure in Castle Pines takes on a uniform look and feel. The guidance also ensures that roadways support community values through the types of travel opportunities that are supported and the interaction between different modes of transportation. Roadway design guidance does not conflict with nor take the place of the Douglas County Design Standards followed by the City of Castle Pines. Instead, they provide more locally-focused guidance that helps create a community-based transportation network.

Community design features are a means of celebrating the character of Castle Pines visually. Community character may be celebrated through unique signage, gateway projects, pavement markings, or other elements of the built environment. More information on roadway design guidance and community design features can be found in the Transportation Solutions section.

Issue Area: Congestion Management

Most Castle Pines residents leave the city to work while most jobs located within the City are filled by outside workers. Dependence on single-occupancy vehicles is high, making the need for smooth traffic flow and access and egress to the community an important quality of life consideration. Managing congestion entails balancing vehicle

traffic flow with other local needs, and is most appropriate as a set of strategies along the City's principal and minor arterials. The efficiency of motor vehicle travel must be balanced against the desire to provide safe roadway conditions and increase transportation options through improved multi-modal infrastructure. Improving roadway efficiency without adding excess capacity is an important consideration since additional lane miles bring higher maintenance costs.

Connection to Master Transportation Plan Goals:

- Goal I: Develop a safe, efficient, multifunctional transportation network designed to promote connections to local destinations
- Goal II: Facilitate cost-effective operations and roadway maintenance strategies

General Purpose of Managing Congestion:

- Maximize utility of existing infrastructure rather than build additional roads or travel lanes
 - Improve traffic operations with Castle Pines by reducing delay and improving travel time reliability
 - Employ access management to improve traffic flow and reduce turning conflicts

Issue Area: Access and Network Connections

The Comprehensive Plan identified limitations to the Castle Pines roadway network and a lack of connections between off-street bicycle trails and sidewalks or bicycle lanes. Improved site access, network connections, and removing gaps in the system ensure that motorists, bicyclists, and pedestrians all have safe and efficient means of reaching destinations and frequenting local businesses. Simple connections between residential areas and retail centers can have important economic development benefits.

Connection to Master Transportation Plan Goals:

- Goal I: Develop a safe, efficient, multifunctional transportation network designed to promote connections to local destinations
- Goal IV: Increase pedestrian connectivity, accessibility, safety, and comfort.
- Goal VI: Develop transportation infrastructure that supports mixed-use development and walkable retail centers

General Purpose of Access and Network Connections:

- Promote access to destinations for all modes

- Increase potential for trips by walking and bicycling and improve safety through dedicated infrastructure connections
- Ensure appropriate access for motor vehicles
- Provide sufficient roadway network density to support new growth
- Balance traffic flow with support for commercial and retail activity
- Create roadway and trail connectivity rather than indirect travel options such as circuitous roadways and cul-de-sacs that discourage local trips

Issue Area: Bicycle and Pedestrian Facilities

Increasing transportation options and improving infrastructure for non-motorized travel modes are major objectives for the City of Castle Pines. Through the Blueprint Process, Castle Pines is taking a Complete Streets approach to new road construction and by utilizing roadway maintenance and reconstruction opportunities to reconfigure existing roads with infrastructure that provides safe travel options for all users. A well-rounded transportation network can support high quality of life by making it safer and easier to complete local trips without a private vehicle and consequently promoting local economic development and retail opportunities.

Connection to Master Transportation Plan Goals:

- Goal I: Develop a safe, efficient, multi-functional transportation network designed to promote connections to local destinations
- Goal III: Develop bicycle infrastructure network to support increased commuting trips and serve the needs of all types of cyclists
- Goal IV: Increase pedestrian connectivity, accessibility, safety, and comfort.

General Purpose of Bicycle and Pedestrian Facilities:

- Increase transportation options
- Address gaps in infrastructure
- Build off network of paved trails and support access to local destinations
- Invest in alternative modes to meet the demand for increased transportation options

Applying the Blueprint Process

The Blueprint Process is meant to highlight design considerations and infrastructure needs for a particular location. As such, each issue area is included in the Blueprint Process, although some components may be more relevant than others for a particular situation, it is comprehensive so that it captures various project types and sizes.

The Blueprint Process may be applied in two ways. One type of use depends on a preliminary understanding of the issues affecting a specific location, such as pedestrian safety issues at a particular intersection or accessing an individual site. Decision-makers may use the Blueprint Process to validate the viability of a desired improvement against the available right-of-way and consider whether the existing infrastructure meets desired standards. It should be noted that multiple issues and objectives may arise for a location, and that these objectives may be in conflict. In these cases, the Blueprint Process can provide a means of considering how best to balance competing interests and guide designers towards potential improvements.

The Blueprint Process may also be utilized as an initial screening to assess the needs for a particular location. This approach is most appropriate during regularly scheduled roadway maintenance or reconstruction to review the conditions and dimensions of the roadway and determine whether minor changes in street design may be applied to meet the general design guidance provided in the plan.

For all applications, a review of existing conditions, evaluation of roadway performance, and consideration of design review questions should be undertaken. Applying these steps will help determine if desired improvements are feasible and appropriate given the existing and anticipated roadway conditions.

The table below provides the steps that should be followed and the data that should be reviewed as part of the Blueprint process. Since the framework may be applied for both simple and complex projects, not all elements may be relevant. **Highlighted questions** are intended to contrast existing roadway conditions and configurations against the guidance contained in plan's roadway design guidance (see the Transportation Solutions chapter for more information).

Appendix A contains a table of potential strategies by issue area. The table discusses the situations in which each strategy is most appropriate, and references the relevant questions from the Blueprint Process design review table. Appendix B provides examples of the Blueprint Process applied to roadway segments across Castle Pines. The examples link the questions contained in the design review table to roadway design standards and provide brief analysis and recommendations. The Blueprint Process, and the examples provided in Appendix B, are not intended to replace the engineering design process.

TABLE 5 BLUEPRINT PROCESS DESIGN REVIEW TABLE

Design Considerations	Characteristics
Step 1: Existing Conditions	
Functional Class	
Available Right-of-Way	
Posted Speed	
Roadway Configuration: Number of Travel Lanes	
Roadway Configuration: Width of Travel Lanes	
Roadway Configuration: Medians and Turn Lanes	
Alternative Mode: Bicycle Lanes (Y/N)	
Alternative Mode: Bicycle Lane Width	
Alternative Mode: Sidewalks (Y/N)	
Alternative Mode: Sidewalk Width	
Landscaping Features	
Land Use: Current Uses Along Project Area	
Land Use: Future Uses Along Project Area	
Desired Connections Along Project Area	
Step 2: Roadway Performance	
Operations: Current ITS Infrastructure	
Operations: Current Level of Delay or Congestion	
Operations: Source of Delay or Congestion	
Question: Could additional capacity be provided through TSM improvements or turn bays and intersection turn lanes?	
Does the roadway have sufficient capacity to support current travel demands?	
Does the roadway have sufficient capacity to support future travel demands?	
Step 3: Roadway Design	
Design Guidance: Is there desired infrastructure that is not included in the current roadway design?	
Design Guidance: Are general purpose lane widths consistent with roadway design guidance?	
Design Guidance: Could lane widths be reduced?	
Site Access: What are the major traffic generators along the project area?	
Site Access: What types of trips are generated? What time of day are trips generated?	
Pedestrian Accommodation: Are there pedestrian generators near the project area?	

Pedestrian Accommodation: Where are the nearest pedestrian crossings?	
Pedestrian Accommodation: 'Is there adequate site access provided between and within high pedestrian areas?	
Pedestrian Accommodation: Are there adequate median refuges to support pedestrian crossings?	
Pedestrian Accommodation: Do pedestrian crossings meet local access guidance?	
Bicycle Infrastructure: Does the corridor or location provide a critical bicycle connection?	
Bicycle Infrastructure: Are bicycle buffers appropriate in this location?	
Bicycle Infrastructure: Are bicycle lanes of desired width?	

Interpreting the Findings of the Blueprint Process

A critical component of the Blueprint Process is for planners and designers to review and contrast existing conditions against the guidance contained in the Castle Pines Master Transportation Plan. In particular, when determining which types of infrastructure improvements to pursue, it is important to pose the following questions to consider how best to balance the needs of the transportation system.

- Will congestion management strategies negatively impact bicycle and pedestrian travel?
- Can traffic flow benefits be obtained without adding additional travel lanes?
- Can bicycle lanes be added without compromising vehicle traffic flow?

Based on the issue being addressed, different roadway elements may be prioritized. The Blueprint Process may reveal that no major improvements along a roadway are necessary. On the other hand, not all transportation infrastructure is possible in all situations. The Blueprint Process encourages stakeholders to assess their priorities for particular locations and to determine if the overall needs of the transportation system can be met through different roadway configurations. In short, the Blueprint Process asks critical questions and encourages that the transportation system offer a balanced approach to addressing sometimes competing priorities. In so doing, the Blueprint Process documents the decision-making approach for the public and encourages a comprehensive and reflective approach in the planning and design of the Castle Pines transportation system.

IMPLEMENTATION: TRANSPORTATION SOLUTIONS

Transportation infrastructure can reinforce community values by ensuring that roadways and other street elements take on consistent form and functions. Rather than prescribe engineering standards as included in the Douglas County Roadway Design and Construction Standards, the transportation solutions provided in this plan focus on two elements of the City's transportation infrastructure: 1) the roadway components contained in typical cross-sections; 2) roadway design features, such as signage and pavement markings, that support the residential community character of Castle Pines.

The guidance provided here is compliant with national standards and based on Complete Streets principles, including a desire to improve transportation options and network connectivity. As such, the design guidance calls for roadway elements and dimensions that improve multi-modal infrastructure and balance mobility and traffic flow with local access, and in so doing promote the unique character of Castle Pines.

It is also important to note that cost, maintenance, and safety should all be considered prior to determination of location-specific design modifications, or the pursuit of community character enhancements.

Guidance for Roadway Elements

Many communities develop local roadway design standards as a means of ensuring that local infrastructure supports local needs and objectives. Instead of relying exclusively on regional or national standards, such as the Douglas County Roadway Design and Construction Standards and *A Policy on Geometric Design of Highways and Streets* from the American Association of State Highway and Transportation Officials (AASHTO), Castle Pines can provide more specific guidance through this document on the desired presence and widths of basic roadway elements.¹⁴ Local roadway design guidelines provide an opportunity to ensure consistent community-specific design features and roadway elements. This "design guidance" would not replace the use of the Douglas County Roadway Design and Construction Standards,

¹⁴ Douglas County produced a set of Roadway Design and Construction Standards, which provide local guidance but are not calibrated to a small town residential community such as Castle Pines.

it would simply provide a more personalized layer for the Castle Pines community. This effort will support the overarching transportation mission of enhancing a well-received and consistent community character for all of Castle Pines. Table 6 below provides standard dimensions and features by functional classification.¹⁵

Right-of-way and roadway type are determinants of the scale and uses supported by different facilities, and set priorities for which roadway elements may be most appropriate given the land use context and the policy objectives of Castle Pines. The guidance may also be utilized for establishing the right-of-way to be set-aside for planned facilities and for future roadway needs as part of new development projects.

Guidelines for basic roadway elements are presented in Table 6 as ranges rather than fixed values to allow for flexibility based on right-of-way constraints and the surrounding land use context. For retail and mixed use areas that generate higher levels of pedestrian travel, narrower travel lanes and wide bicycle lanes and pedestrian infrastructure are desired. Landscaping buffers and pedestrian refuge also become higher priority elements in these locations.

The roadway design guidance provided in the Castle Pines Transportation Master Plan should be utilized during the planning, design, and construction of new roadways, as well as when considering reconstruction of existing roadways. In particular, this guidance is intended to be used as a reference when applying the Blueprint Process as it provides guidance on widths for roadway elements, such as travel lanes and bicycle lanes, as well as roadside elements, such as sidewalks and pedestrian or landscaping buffers.

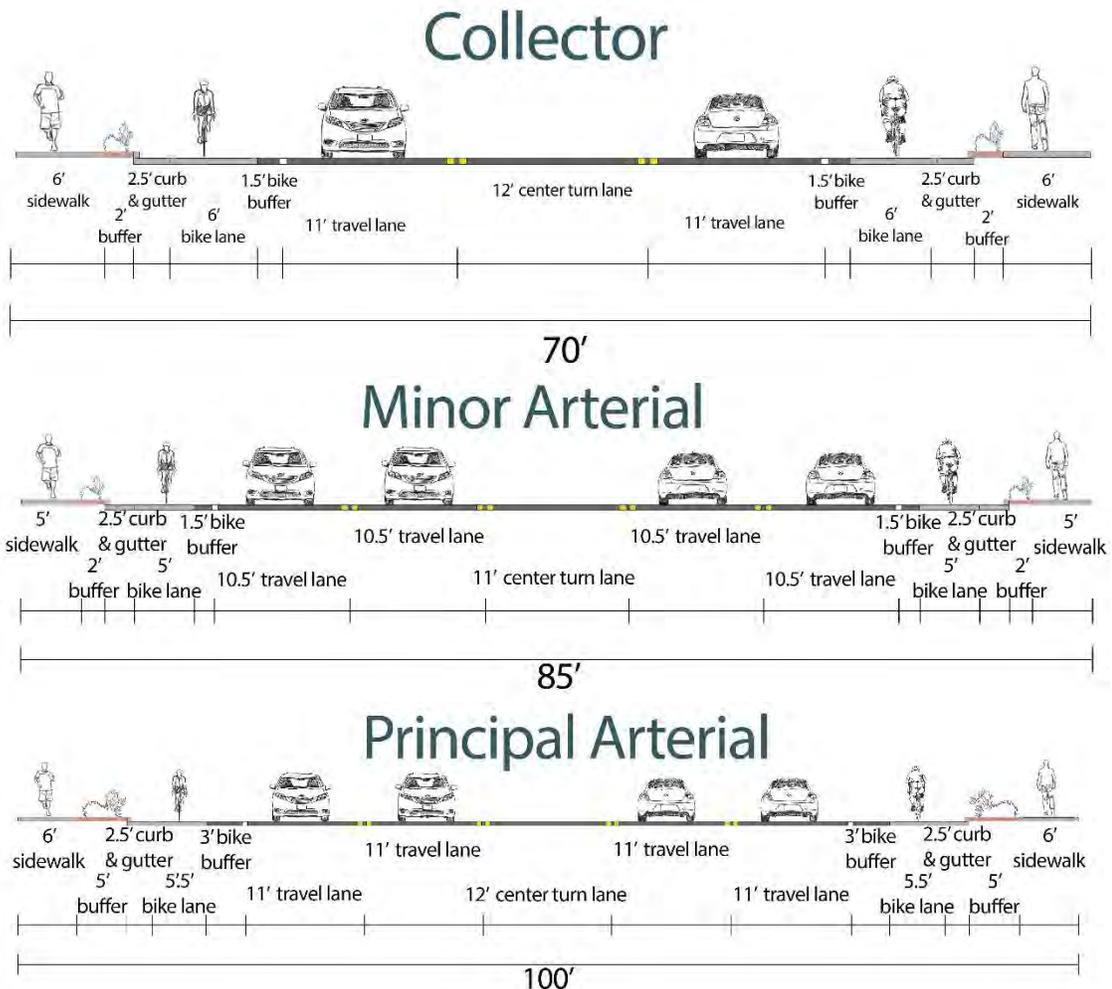
Roadway designers should refer to AASHTO or NACTO for engineering standards for design elements such as horizontal and vertical curves, sight distance, and curb radii. Similarly, this plan does not contain guidance on intersection design or the design vehicle appropriate for each road. Accommodations for bicyclists at intersections should be taken from AASHTO or NACTO design manuals. The Douglas County Roadway Design and Construction Standards may also be used for more detailed guidance on the technical standards for roadways in Castle Pines.

15 The standards provided here are generally based on the ITE manual *Designing Walkable Urban Thoroughfares: A Context Sensitive Approach*, published in 2010, along with other best practices in Complete Streets design. Right-of-way ranges are taken from the Douglas County Roadway Design and Construction Standards.

Table 6 includes guidance of basic roadway elements and the example typical cross sections below utilize the dimensions suggested in the plan.

TABLE 6 STANDARDS FOR BASIC ROADWAY ELEMENTS

Roadway Type	ROW Range	Travel Lanes	Travel Lane Widths	Center Turn Lanes	Sidewalks	Landscaping Buffer	Bike Lanes	Bike Buffer	Design Speed (MPH)
Principal Arterial	100-150	4	10-12'	12'	5-6'	4' or more	5-6'	1.5-3'	35-40
Minor Arterial	80-125	2-4	10-11'	11-12'	5-6'	4'	5-6'	0-1.5'	30-35
Major Collector	60-100	2	10-11'	10-11'	5'	2-4'	5'	0'	30
Minor Collector	50-85	2	10-11'	10-11'	5'	2-4'	5'	0'	25-30
Local	40-60	2	9-11'	N/A	5'	0-4'	N/A	N/A	25



Key Roadway Elements

Lane Widths

The width of general purpose lanes impacts the speed at which vehicles travel along a roadway, making lane widths a means of supporting the residential community character of Castle Pines. Lane widths vary by functional class, with narrower lanes generally found on roadways with lower classifications.

Research increasingly shows safety benefits associated with narrow lanes, although there is a minimal decrease in roadway capacity. Narrower lanes also ensure non-motorized travel modes can safely coexist with vehicle travel, as they provide for reduced speed and additional space for non-motorized roadway users.

In Table 6, lane widths are presented as ranges rather than fixed values to allow for flexibility based on the location and context.¹⁶

Medians

Medians separate general purpose travel lanes moving in opposite directions, and may include features to provide safety benefits and improve operations by providing space for turning vehicles. Some form of raised or striped median is desirable on principal and minor arterials, with wider medians where turn lanes or turn bays are required.

Medians may also serve as pedestrian or bicycle refuges, whether as raised features or through pylons, pavement markings, and signage that distinguishes the pedestrian safe zone. Pedestrian refuges where there is no center turn lane should be at least 6' in width.



EXAMPLE OF PEDESTRIAN REFUGE

¹⁶ Roadway design guidance, including lane widths, medians, and pedestrian infrastructure, are generally taken from ITE Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, 2010. Guidance on bicycle infrastructure is also taken from the National Association of City Transportation Officials Urban Bikeway Design Guide.

While raised medians are the safest form of pedestrian refuges, pavement markings may serve as pedestrian refuges within a center turn lane on lower classification facilities.¹⁷

Table 6 provides guidance on center turn lane widths, which may be incorporated as part of a median. Options for medians and center turn lanes include:

- Two-way left-turn lanes
- Raised medians with intersection turn bays
- Median refuges for pedestrians and cyclists
- Median landscaping buffer

For arterial roadways, the median and center turn lane space should be 10-12', plus an additional 6' pedestrian refuge at intersections. Pedestrian refuges are most critical where there are two or more travel lanes in each direction.¹⁸



EXAMPLE OF A BICYCLE BUFFER

Bicycle Infrastructure

Bicycle lanes should be a minimum of 5' in width and, where feasible, should be included on all facilities classified as collectors and above.

Bicycle buffers are the additional space that separates a bicycle lane from the outside edge of a general purpose travel lanes. Buffers are most appropriate on higher speed facilities (e.g. 35 MPH and above), including principal arterials.¹⁹

¹⁷ Image Credit: <http://nacto.org/publication/urban-street-design-guide/intersection-design-elements/crosswalks-and-crossings/pedestrian-safety-islands/>

¹⁸ Along arterial roadways in areas where right-of-way is constrained, the width of raised medians can be reduced to a minimum of 10' and still accommodate a left-turn lane (ITE, p. 66).

¹⁹ See NACTO Urban Bikeway Design Guide for more details.

Image Credit: <http://www.minneapolis.gov/bicycles/buffered-bike-lane>

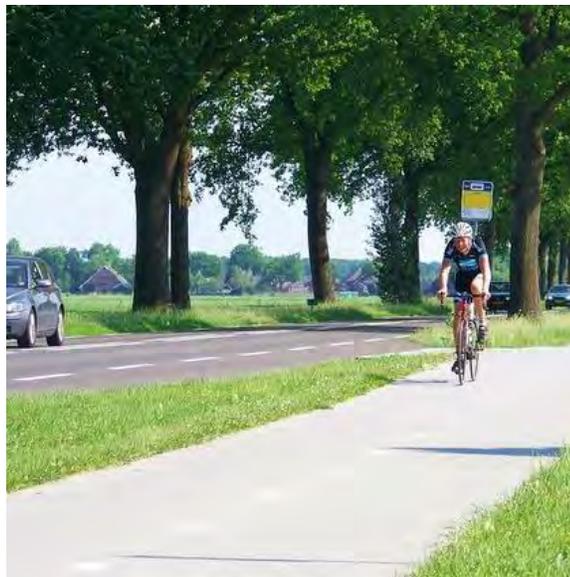
Other types of bicycle infrastructure may be pursued as appropriate. See discussion on bicycle boulevards and multi-use paths. Designers should also consider whether safe bicycle facilities could be included within the available right-of-way envelope, or along a parallel facility.

Bicycle boulevards are an increasingly common means of providing bicycle infrastructure on low volume local roadways that provide important connections across the network. These facilities are shared between bicycles and vehicles and contain distinct pavement marks and signage that designate the route as appropriate for cyclists (note that physical barriers are not present on bicycle boulevards). Bicycle boulevards generally feature low speed limits and encourage cyclists to travel with the flow of traffic.²⁰

Multi-use paths are an appropriate substitute for on-street bicycle facilities, in particular along higher speed facilities. Since multi-use paths appeal to less confident cyclists and recreational users, they may also be desirable alongside on-street facilities, which are generally preferred by more experienced riders.²¹



EXAMPLE OF A BICYCLE BOULEVARD



EXAMPLE OF MULTI-USE PATH

20 Image credit: https://en.wikipedia.org/wiki/Bicycle_boulevard

21 Image credit: <http://www.aviewfromthecyclepath.com/2014/04/is-that-shared-use-path-do-dutch-cycle.html>

Pedestrian Infrastructure

The standard *sidewalk* width is 5', though a width of 6' is desirable for principal arterials given the higher vehicle travel speeds. Sidewalk widths depend on the land use context as well as the roadway. Sidewalks must be ADA compliant. Wider sidewalks, including widths of up to 10', are desirable in mixed use and town center areas where higher levels of pedestrian travel occurs.²²

Sidewalk width refers to the unobstructed area, also known as the clear distance or the effective width of the sidewalk from edge to edge. The sidewalk width does not include the shy distance, the space between the sidewalk edge and the built environment.

Pedestrian / landscape buffers refer to the space between the sidewalk edge and the curb that may be utilized for landscaping, utilities, Manual on Traffic Control Devices (MUTCD) signage, and public amenities such as benches and bicycle racks. Landscaping buffers are desirable as space permits. Wider sidewalk buffers are preferred on higher speed roadways. All roadways should provide a buffer between the sidewalk edge and the curb if possible.

Pedestrian refuges in crosswalks and medians are desirable on principal arterials in mixed-use and retail areas. Pedestrian refuges should be 6' or more in width.



EXAMPLE OF ADA COMPLIANT
SIDEWALK WITH LANDSCAPE BUFFER

“In more conventional suburban areas that are intended to remain so, arterial spacing of up to one mile may suffice if facilities of up to six lanes are acceptable to the community. The arterial thoroughfares should be supplemented by thoroughfares spaced at most one-half-mile apart. Such areas typically are interspersed with areas of mixed-use and walkable activity, such as commercial districts and activity centers. These centers require more frequent and connected networks of local streets.”

ITE, *DESIGNING WALKABLE URBAN THOROUGHFARES, A CONTEXT SENSITIVE APPROACH*, 2010, P. 31)

²² Image credit: <http://www.ite.org/uiig/ada.asp>

Crossings and Intersection Spacing

The most efficient roadway networks – and the networks most conducive to walking and bicycling – provide parallel streets and frequent intersections (e.g. arterial roadways spaced ½-mile apart or less). It may not be appropriate to apply the level of network density prescribed in urban design manuals to all locations in the City of Castle Pines. However, given the public desire to support multi-modal transportation, some elements for walkable urban communities should be applied as new areas develop.

Pedestrian *crossings* should be considered every ¼ to ½-mile. In locations with higher levels of pedestrian activity, such as near schools or retail centers, pedestrian crossings should be considered every ¼-mile.²³

Other Considerations

Limited Right-of-Way

The allocation of right-of-way space and the dimensions and scale of roadways are means of demonstrating community values. For example, narrow lanes can encourage slower speeds which can address roadway safety and operational needs while reinforcing residential character. Such conditions support the image of Castle Pines as a safe place for families by discouraging long-distance through travel and providing safe infrastructure for pedestrians and cyclists. The types of infrastructure that are provided are also critical for reinforcing local values, including safe on-street bicycle infrastructure and a trails system that connects parks and open spaces.

However, the application of roadway design standards may be challenging in locations where right-of-way is restricted. This is particularly true for projects involving the restriping or reconstruction of existing roadways. Unlike new roadways, which offer a blank slate upon which all desired roadway elements may be added, instances where right-of-way is limited may involve some level of prioritization of space for the most critical elements.

For existing roadways or locations with limited right-of-way the standard widths provided in Table 6 reflect the desired dimensions for roadway elements. Not all elements of Table 6 are required in all situations.

23 ITE, Designing Walkable Urban Thoroughfares, A Context Sensitive Approach, 2010, p. 31

Access and Connectivity

Providing a range of transportation options depends on more than just the presence of critical infrastructure on major roadways. Motorists, bicyclists, and pedestrians alike must be able to connect to major roadways from residential areas and access local businesses or parks and recreational sites. A well-connected roadway network can also reduce vehicle miles traveled and improve emergency response times.

The Castle Pines roadway network is marked by cul-de-sacs and limited network connectivity that often require circuitous routes to access local neighborhoods. Although such roadway design supports the residential character of Castle Pines, there are ways to encourage a more multi-modal transportation network. Measures that Castle Pines can take include avoiding cul-de-sacs in new developments and preserving pedestrian pathways when approving development plans. For new developments, and where possible in existing developments, Castle Pines can provide non-motorized neighborhood access points where roadway networks are limited to better connect residential areas to arterial roadways and local destinations. Street spacing and the frequency of pedestrian and bicycle crossings can also improve site access for non-motorists.

Travel needs of motorists can be addressed through access control measures, which limit the number of driveways and reduce the number of turning movements, thereby improving traffic flow. Castle Pines can also ensure large-scale network connectivity through the layout of future roadways. Signalized intersections should be provided among collectors and arterials generally every half-mile.

Curb Return Radii

Intersection design and curb radii affect the speed at which vehicles complete intersection turning movements, as well as the distances that pedestrian must travel to cross intersections. Large curb radii ease turning for large vehicles, but force pedestrians to walk longer distances to arrive at their destinations. According to NACTO, “In urban settings, smaller corner radii are preferred and actual corner radii exceeding 15 feet should be the exception.”²⁴

²⁴ <http://nacto.org/publication/urban-street-design-guide/intersection-design-elements/corner-radii/>

Community-Specific Design Characteristics

In addition to the scale of roadways and the elements in each cross-section, there are opportunities to reinforce community identity and present community-specific values through the physical design of roadways. These design characteristics include visual markers, signage, symbols, landscaping, and other elements that let residents and visitors alike know they are in Castle Pines. Applying design characteristics across the established and newly-developing sections of Castle Pines also provides an opportunity to forge a common identity through transportation infrastructure.

This section provides a menu of options that could be employed to complement transportation infrastructure and creatively advertise the unique character of Castle Pines. Particular design features include:

- Pavement markings
- Unique bicycle signage and stencils
- Crosswalk design features
- Gateway projects
- Signage and wayfinding
- Public spaces
- Landscaping in public right-of-way

Pavement Marking

Pavement markings are part of a communication system for road users; in addition to signs and signals, pavement markings communicate to drivers where to position their vehicles, warn about upcoming conditions, and indicate where passing is allowed. They are also an opportunity to add unique character to the roadway. Between using green paint (or another unique color) and whimsical bicycle lane markings, there are myriad possibilities. The example image contains a bicycle lane marking in Portland, OR that adds a unique element to the street design.²⁵



EXAMPLE OF PAVEMENT MARKING

Castle Pines could complement its vast paved trails network with design features

²⁵ Image credit: <https://pdxcentric.wordpress.com/c4-bike-guys/>

and marking. The trails are already a unique feature that establishes Castle Pines as a place that values recreational opportunities and open space; pavement markings could further differentiate the community.

Crosswalk Design

Good crosswalk design calls attention to drivers, preventing conflicts. Crosswalks are both a guide for pedestrians and a way to communicate crossings to motorists. Common design elements include lighting, signage, painted pavement markings, and raised features such as bollards or pylons. When pedestrian traffic is low, or where vehicle volumes are lower and pedestrian crossings shorter, the use of unsignalized crossing designs such as medians, hybrid or rapid flash beacons, or raised crossings are useful. The example images provide ideas for modern crosswalk designs.²⁶



EXAMPLE OF CROSSWALK DESIGN

Sidewalk Design

The design of pedestrian facilities can also add character to a corridor. Walkways can be made of any number of materials, including brick, tiles, stones, or concrete. Sidewalks may have unique patterns, colors, or inlaid signage to help create an aesthetic or to meet a practical need. In the name of low impact development, the use of permeable materials helps reduce water runoff.²⁷



EXAMPLE OF SIDEWALK DESIGN

²⁶ Image credit: <http://www.wreco.com/projects/civildesign/smithstreet.html>

²⁷ Image credit: <http://thecityfixbrasil.com/2015/04/01/nossa-cidade-os-oito-principios-da-calcada/>



RENDERING OF CASTLE PINES GATEWAY

Gateways

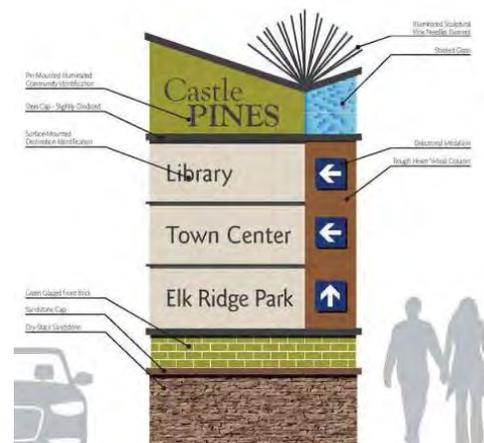
Gateways are significant points of entry into a community and can represent the community's front doorstep. Unique signage and public art at these sites can reinforce the identity of a place and provide a clear sense of a community or neighborhood boundaries. Because they often provide the first impression of a community, gateways represent an important opportunity to convey a positive and lasting image.

Wayfinding & Signage

Unique signage is a simple means of indicating presence in a particular community. Designs can reflect local arts and culture, and can serve the dual purpose of navigating visitors and residents and creating a sense of place.

Alternatively, signage can be prepared for the benefit of pedestrians and cyclists. Most signage is designed for cars; usually signs are large, face the road, and indicate the distance (in miles) to reach a destination. By contrast, pedestrian or bicycle-oriented signage often indicates how many minutes it would take to arrive at a place or intersection.

The Castle Pines City Council expressed interest in gateway improvements, wayfinding signage, and other design elements to enhance the community brand. Locations identified for gateway features are near the intersection of Castle Pines Pkwy and I-25; locations for wayfinding are throughout the Village Square Shops.



RENDERING OF CASTLE PINES WAYFINDING SIGNAGE

IMPLEMENTATION: POLICY OPTIONS

Participate in Regional Transportation and Planning Organizations

There are a growing number of transportation challenges facing Castle Pines residents, including travel on roadway facilities outside of city limits that experience high levels of congestion and affect residents' ability to reach their destinations, including home. The vast majority of Castle Pines residents leave the community for work, and nearly all commuters rely on I-25 – which is going to get increasingly congested over time – to access employment sites. Likewise, the vast majority of jobs in Castle Pines are filled by residents who must travel from outside city limits.

Castle Pines residents and workers are thus engaging in regional transportation patterns, commuting relatively long distances across jurisdictions on a daily basis (two-thirds of Castle Pines residents travel more than 20 minutes to get to work). Providing adequate options and ensuring that Castle Pines residents can access their desired destinations in a timely manner is a quality of life issue for Castle Pines residents. However, ensuring that commuting trips and other travel needs can be taken efficiently is a long-term regional consideration. To preserve quality of life for Castle Pines residents therefore requires a broad focus and participation in long-range regional transportation planning.

Now that the City of Castle Pines has joined DRCOG, participation in the regional planning process will be critical. DRCOG performs a range of planning activities, including population, employment, and travel projections; establishing a vision for growth in the region; collecting transportation data; and determining long-range regional transportation strategies to improve mobility over time. DRCOG is also responsible for the programming of federal transportation funds available to the Denver metropolitan area. Through participation in regional boards and committees through DRCOG, Castle Pines has the opportunity to influence regional decision-making, including the selection of projects for federal funding.

Castle Pines may also consider membership in the Regional Transit District (RTD). The RTD operates transit services across the Denver metropolitan area, including eight light rail lines and more than 150 bus transit lines. Through its FasTracks program, the RTD is in the midst of an ambitious expansion plan to improve

Potential Transit Services Available Through RTD Membership

Call-n-Ride is a personalized bus service provided in many smaller communities across the RTD. Call-n-Ride requires users to schedule an appointment in advance and for a basic fare, allows users to connect to work, school, and appointments, or to nearby RTD stations.

Access-a-Ride provides local bus rides area for people with disabilities who cannot access the fixed-route bus and rail system. Starting points and destinations must be within 3/4 mile of RTD's local fixed-route transit system.

SeniorRide provides shuttle service for groups of ten or more to cultural, educational, and entertainment events. The service is intended for individuals who have difficulty driving or riding fixed route service, and picks up groups at senior housing complexes and community centers

transit options across the Denver metropolitan area. The closest light rail service, the southeast rail line, is in the middle of a 2.3-mile extension in Lone Tree from Lincoln Station to RidgeGate Pkwy.

Participation in these agencies could improve services for Castle Pines residents, as well as access to federal funds. Membership would also ensure Castle Pines is represented in the regional dialogue on growth patterns, roadway and transit expansion projects, and the best means of addressing transportation needs.

Travel Demand Management Programs

Whether pursued independently or through services offered by DRCOG, Castle Pines can pursue low-cost steps to increase transportation options for its residents, reduce dependency on single-occupancy vehicles, and reduce peak period congestion along I-25 through travel demand management programs (TDM). DRCOG's Way to Go program in particular is designed to reduce vehicle miles traveled and improve air quality through carpooling, ridesharing, promotional events related to biking and walking, and other activities designed to reduce the number of individuals driving single-occupancy vehicles to work.

The simplest form of TDM are ridesharing programs that pair residents traveling to common destinations. Such a program in Castle Pines could directly address the high percentage of residents that commute to work in single-occupancy vehicles.

Transit Service Expansion

There is an opportunity for Castle Pines to leverage the RTD's expansion of transit service and meet the needs of residents and workers employed in Castle Pines who must

commute to the community. In particular, transit service is a means of providing increased choice, connecting Castle Pines with the rest of the region, and making the city appealing to residents over the long-term.

In the near-term, Castle Pines may consider means of providing access to the light rail station at RidgeGate Pkwy in Lone Tree (opening in 2017) via shuttle services, or engaging in a partnership with ridesharing companies to reduce the need for single-occupancy vehicle trips to and from station areas.²⁸ Castle Pines may also consider a formal transit-oriented development (TOD) planning process for the area around the I-25 / Castle Pines Pkwy interchange, the most logical location for future extensions of the RTD light rail or bus rapid transit networks. Pedestrian-oriented design in this area will be particularly important.

In the long-term, an internal transit connection to I-25 and Castle Pines Pkwy may be appropriate to connect outlying areas of the city with retail services, local destinations, and future transit stations. It should be noted that providing transit service is not without costs. However, those costs may be shared through participation in regional transit programs and request of federal transit funds.

Access Management

Castle Pines would benefit from an access management planning effort followed by associated policies and potentially a driveway permit process. Some of the immediate benefits would include improving safety and traffic operations along primary arterials, especially Castle Pines Pkwy. Managing access builds consistent travel patterns, results in clear pathways for vehicles versus pedestrians and bicyclists, and minimizes conflicts associated with turning movements. Finally, it supports the overarching goal of enhancing community design features by encouraging a bit of “clean up” along the roadway, resulting in more continuous non-motorized facilities. Driveway spaces can also be reallocated for physical elements which support the transportation system, such as signage, wayfinding, and aesthetics. Once established, area businesses would find access management advantageous as well because customers find it easier and safer to access the local establishments.

There are many existing driveway and access points that would benefit from consolidation, but the City could also ensure that new development is created in a

28 In 2016, Centennial, CO entered into a partnership with Lyft to provide subsidized trips to and from the Dry Creek light rail station.

consistent way through access management. The creation of an access management plan would help identify the best approach to consolidation of driveways as well as build a decision-making structure for future access points. This will help build a unified approach for various types of access points, both new and existing. The analysis expected in an access management plan will provide a better understanding of adjacent roadway impacts as well as what opportunities may exist for community design features and improved pedestrian/bicycle facilities. An access management plan could help identify when and how traffic impact analyses studies should be undertaken, what type of improvements would be expected by the private sector, and minimize overall impacts to the roadway system.

The most critical location for an access management plan is along Castle Pines Pkwy. Therefore, perhaps the City begins with a dual-approach: overarching access management plan to consider policy modification, along with a location-specific plan to create direct infrastructure modifications for Castle Pines Pkwy. It would require a significant amount of coordination and will not result in immediate changes to access. It will, however, establish expectations for future modifications. With a driveway permit process in place, these modifications can be required upon every change in use or ownership. This will allow the City, over time, to manage and improve access along this major arterial, and set the tone for other locations as well.

Complete Streets

The roadway design guidance contained in this plan could be further supported through formal Complete Streets policies. Complete Streets is an approach to roadway design that accommodates all users – including motorists, bicyclists, and pedestrians – of all ages and ability levels. Complete Streets also supports many of the goals and objectives of the Castle Pines Master Transportation Plan. Benefits could include safe connections to schools, strengthen existing design practices, and establishing Castle Pines as a community that values a multi-modal transportation system. Finally, such policies would provide the City a platform with which to require private development of neighborhoods and commercial areas to incorporate more opportunities for non-vehicular connectivity.

APPENDICES

APPENDIX A

BLUEPRINT PROCESS: APPROPRIATE STRATEGIES

Strategies & Appropriateness		
Issue Area	Strategy	Relevant Questions
Congestion Management	Capacity Expansion	Where right-of-way exists such that a road can be widened without compromising ability to accommodate non-motorized travel modes. There must be identified near-term or long-term capacity issues that cannot be addressed through other means.
Congestion Management	Transportation Systems Management	Appropriate as an alternative to roadway widening where increased efficiency and improved travel time are desirable.
Congestion Management	Roundabouts	Roundabouts are appropriate in a variety of circumstances: intersections with irregular designs, turning conflicts, and/or an odd number of approaches; where safety improvements are desired; where the needs of multiple roadway users must be balanced; and gateways to pedestrian areas.
Congestion Management	Access Control	Roadways where improved efficiency and travel time are desired. Access control is particularly appropriate along roads with excess number of driveways. Access control must be balanced against need for pedestrian access and crossings.
Site Access / Congestion Management	Local Access Road	Along high speed or high-volume roads where turning movements and business access impedes traffic flow. Local access roads require sufficient right-of-way parallel to a major road. These facilities may be frontage roads or "backage" roads.
Site Access / Congestion Management	Turn Lanes	Intersections with a high number of turning vehicles and/or subsequent rear-end crashes. Additional right-of-way may be required, or general purpose lanes must be converted to turning lanes. Consideration of bicyclist movements is important.
Site Access / Congestion Management	Network Connectivity	Additional connections are appropriate where roads in Castle Pines are poorly connected and require circuitous routes to complete basic trips. Small connections for pedestrians and cyclists may be provided between roadways and trails or cul-de-sacs.
Site Access	Internal Site Connections	Locations with high levels of pedestrian activity, as well as trips within retail centers or from nearby roads to retail sites.
Site Access / Pedestrian & Bicycle	Crosswalks	Where the nearest signalized intersections are more than 1/2-mile apart. In retail locations and other areas where pedestrian and bicycle activity is encouraged, protected crosswalks should be provided at increased frequency.
Site Access / Pedestrian & Bicycle	Curb Extensions	Appropriate for mid-block crossings or at intersections with high levels of pedestrian activity where lower speeds and reducing the distance required to cross the street are desired.
Pedestrian & Bicycle	Medians / Pedestrian Refuges	In locations with high levels of pedestrian or bicycle activity. Refuges are most appropriate where pedestrian must cross three lanes of traffic or more. Median refuges may be combined with center turn-lanes at mid-block crossings.
Pedestrian & Bicycle	Traffic Calming	Where speeds are excessive or there is undesired through travel. Also appropriate in high pedestrian activity areas.
Pedestrian & Bicycle	Bicycle Lanes	Collector and arterial streets where safe and direct bicycle connection is desired. Wide shoulders may serve as bicycle lanes in more rural areas with lower traffic volumes. Bicycle buffers are appropriate on roadways with higher travel speeds and/or traffic volumes.
Pedestrian & Bicycle	Landscaping Buffers	Where separation is desired between pedestrian and motorists. Most appropriate along roadways with higher speeds and traffic volumes.
Pedestrian & Bicycle	Wider Sidewalks	Although 5' sidewalks are the standard width according to national design guidance, wider sidewalks may be appropriate in areas with high levels of pedestrian activity, such as retail areas or near schools.

APPENDIX B

APPLYING THE BLUEPRINT PROCESS

APPLICATION OF BLUEPRINT PROCESS

Notes on Applying the Blueprint Process

The following examples are for planning purposes as a means of generating ideas and to provide an assessment of the general needs and conditions in a particular location. These examples are not intended to take the place of full engineering analysis. It is expected that detailed engineering analysis would be conducted before beginning the design and construction phases of a project.

Monarch Blvd North of Castle Pines Pkwy

Background

Monarch Blvd is a major collector that provides a critical north-south connection across Castle Pines. The road serves residential areas and carries more than 10,000 vehicles per day.

Analysis

With the important exception of pedestrian infrastructure on the northbound side of the road, Monarch Blvd generally meets roadway design guidance.

Monarch Blvd experiences relatively high volume-to-capacity ratios in the southbound direction in the AM peak period and the northbound direction in the PM peak period. However, the presence of turn lanes and limited access points ensure that congestion is not an issue at present.

An unknown is the extent of additional travel projected along Monarch Blvd over time. Options to widen Monarch Blvd may be limited (and may not be desirable for local residents) if traffic volumes are projected to increase substantially. DRCOG is currently finalizing its 2040 socioeconomic and travel forecasts; these forecasts should be consulted before any changes are considered to the number of lanes.

Monarch Blvd does not contain sidewalks on both sides of the road, though there is a multi-use trail that runs parallel to the roadway. There are limited opportunities north of Bristolwood Ln to access the multi-use trail from residential areas.

The multi-use trail allows for bicycle trips along the corridor. However, the narrow width of the trail (8') means the facility is most appropriate for recreational rather than

commuting uses. The shoulders along Monarch Blvd may be used for on-street bicycling. The northbound direction features a shoulder with a width of 6', which is appropriate for safe on-street bicycling. The shoulder on the southbound side of Monarch Blvd is only 4', which is below general guidance for bicycle infrastructure.

Recommendations

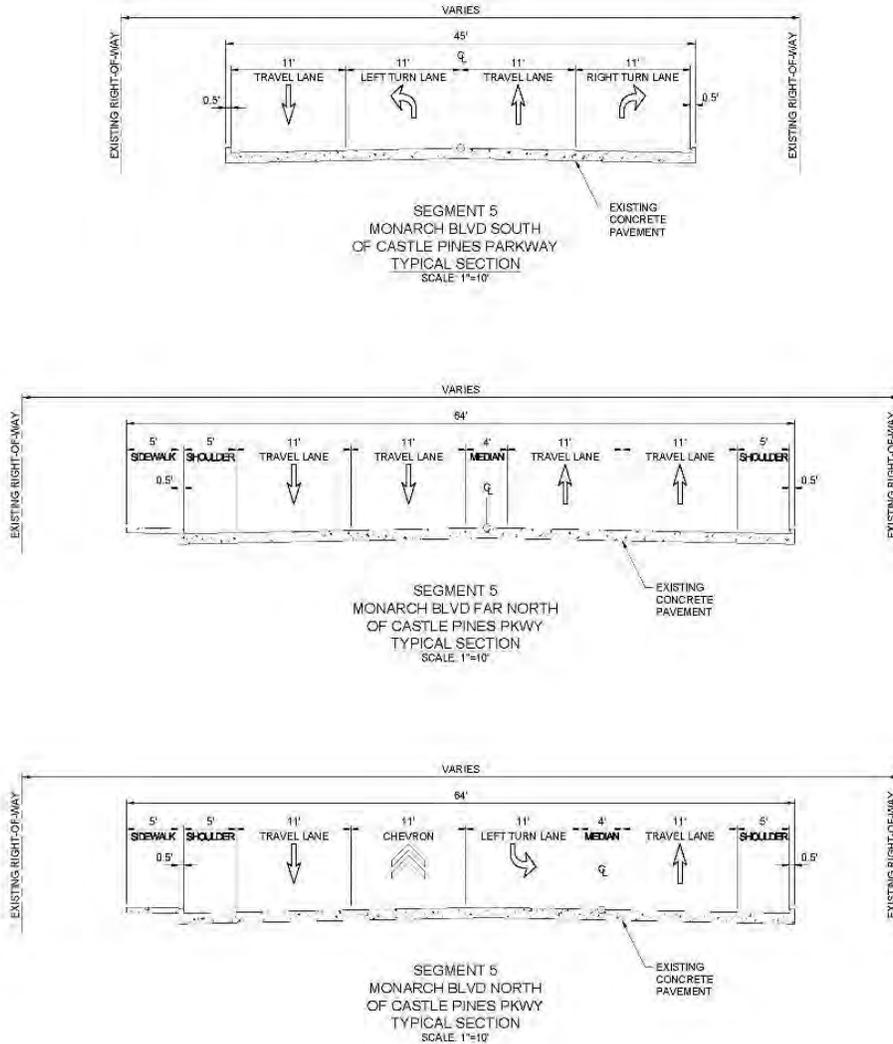
No urgent changes to the configuration of Monarch Blvd are required. However, two items may be addressed as funds permit or as part of a maintenance or rehabilitation project.

- Sidewalks on both sides of the street may not be necessary if sufficient access is provided from residential areas to the multi-use trail. Spur trails should be created from all intersections (such as the spur trail provided at the intersection with Bristolwood Ln).
- As part of a maintenance project along Monarch Blvd, the striping plan should contain 5' shoulders on both sides of the road. If additional bicyclist comfort is desired, travel lanes may be reduced from 11' to 10' to provide wider shoulders or buffers between general purpose lanes and the shoulders.

Design Considerations	Characteristics
Step 1: Existing Conditions	
Functional Class	Major collector
Available Right-of-Way	64' roadway envelope
Posted Speed	35 MPH
Roadway Configuration: Number of Travel Lanes	One lane per direction plus center turn lane
Roadway Configuration: Width of Travel Lanes	11'
Roadway Configuration: Medians and Turn Lanes	Center turn lane; striped median
Alternative Mode: Bicycle Lanes (Y/N)	No - Shoulders are present
Alternative Mode: Bicycle Lane Width	4' shoulder in SB direction; 6' shoulders in NB direction
Alternative Mode: Sidewalks (Y/N)	Yes - SB direction only; Multi-use trail parallel to NB direction
Alternative Mode: Sidewalk Width	SB direction: 5' NB multi-use trail: 8'
Landscaping Features	None
Land Use: Current Uses Along Project Area	Residential / Open space on east side of road

Land Use: Future Uses Along Project Area	No change
Desired Connections Along Project Area	No additional connections
Step 2: Roadway Performance	
Operations: Current ITS Infrastructure	Not applicable
Operations: Current Level of Delay or Congestion	
Operations: Source of Delay or Congestion	PK peak hour V/C ratio SB = 0.7 NB = 0.9
Question: Could additional capacity be provided through TSM improvements or turn bays and intersection turn lanes?	Not applicable
Does the roadway have sufficient capacity to support current travel demands?	Yes
Does the roadway have sufficient capacity to support future travel demands?	To be determined. Consult DRCOG 2035/2040 travel projections.
Step 3: Roadway Design	
Design Guidance: Is there desired infrastructure that is not included in the current roadway design?	Sidewalks on both sides of street
Design Guidance: Are general purpose lane widths consistent with roadway design guidance?	Yes
Design Guidance: Could lane widths be reduced?	Yes, but not necessary. Lane widths could be reduced from 11' to 10'.
Site Access: What are the major traffic generators along the project area?	None
Site Access: What types of trips are generated? What time of day are trips generated?	Through traffic
Pedestrian Accommodation: Are there pedestrian generators near the project area?	None
Pedestrian Accommodation: Where are the nearest pedestrian crossings?	Castle Pines Pkwy, Bristolwood Ln
Pedestrian Accommodation: 'Is there adequate site access provided between and within high pedestrian areas?	North of Bristolwood Ln there are limited opportunities to access the multi-use trail from residential areas.
Pedestrian Accommodation: Are there adequate median refuges to support pedestrian crossings?	Roadway width is modest. Refuges not required.
Pedestrian Accommodation: Do pedestrian crossings meet local access guidance?	North of Bristolwood Ln there are limited opportunities to access the multi-use trail from residential areas.
Bicycle Infrastructure: Does the corridor or location provide a critical bicycle connection?	Monarch Blvd provides important north-south bicycle connection to Castle Pines Pkwy.
Bicycle Infrastructure: Are bicycle buffers appropriate in this location?	Appropriate but not necessary
Bicycle Infrastructure: Are bicycle lanes of desired width?	SB shoulder is only 4' wide. Multi-use trail is 8' wide (PaRC Plan recommends 10').

Typical Sections along Monarch Blvd



Buffalo Trail Rd North of Castle Pines Pkwy

Background

Buffalo Trail Rd is a minor collector that provides access to residential communities in western Castle Pines and serves as a north-south connection between Castle Pines Pkwy and Monarch Blvd. Buffalo Trail Rd is referred to as Old Happy Canyon Rd to the south of Buffalo Ridge Rd. Traffic volume data is not available for the facility.

Analysis

The widths of roadway elements along Buffalo Trail Rd are consistent with guidance contained in the Castle Pines Master Transportation Plan. However, Buffalo Trail Rd lacks pedestrian infrastructure on the southbound side of the road. Pedestrian crossings are not marked, potentially affecting residents along the west side of the roadway, and there are no formal pedestrian crossings along the corridor north of Castle Pines Pkwy. The majority of Buffalo Trail Rd includes a 48' roadway envelope. The posted speed limit is 35 MPH, which may be more appropriate for a major collector or a minor arterial roadway.

Although data is not available, high traffic volumes are not considered an issue along Buffalo Trail Rd. Buffalo Trail Rd serves as a logical shortcut and connection between Castle Pines Pkwy and Monarch Blvd, though increases in traffic volume over time are unlikely as limited housing growth is projected in western Castle Pines.

Buffalo Trail Rd does not have protected turn lanes at intersections with local streets, though volumes may be low enough that turn bays are not necessary.

Despite the fact that many residential streets near Buffalo Trail Rd end in cul-de-sacs, there are frequent non-motorized connections to the external trail and sidewalk networks. Although bicycle facilities are not delineated, the shoulders along Buffalo Trail Rd are of sufficient width to support on-street bicycling.

Recommendations

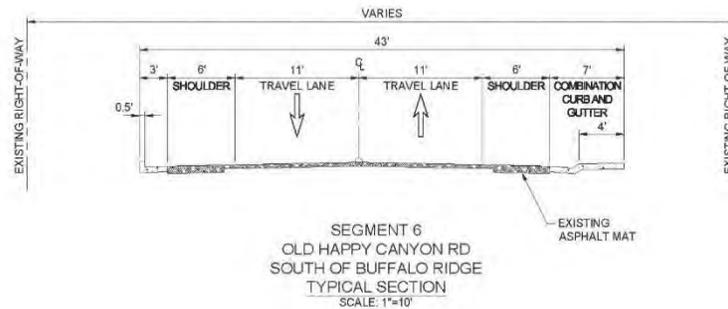
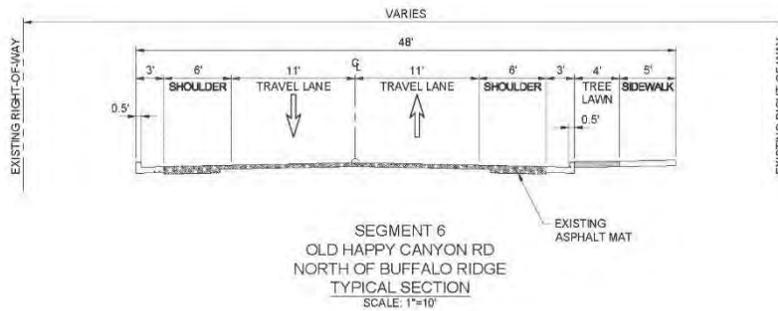
The most critical improvement to Buffalo Trail Rd depends on the available right-of-way; if right-of-way exists, pedestrian infrastructure could be provided on the southbound side of the road. Pavement markings or other pedestrian crossing features could be added to improve connections across Buffalo Trail Rd and provide access to existing sidewalks. Clear signage or other crossing infrastructure are also important due to the relatively high speed limit on Buffalo Trail Rd.

Shoulders could be converted to formal bicycle lanes by adding bicycle stencils and signage to increase driver awareness.

Design Considerations	Characteristics
Step 1: Existing Conditions	
Functional Class	Minor Collector
Available Right-of-Way	Generally 48' roadway envelope
Posted Speed	35 MPH
Roadway Configuration: Number of Travel Lanes	One lane per direction
Roadway Configuration: Width of Travel Lanes	11'
Roadway Configuration: Medians and Turn Lanes	No center turn lane
Alternative Mode: Bicycle Lanes (Y/N)	No - Shoulders are present
Alternative Mode: Bicycle Lane Width	6' shoulders in both directions
Alternative Mode: Sidewalks (Y/N)	Yes - NB direction only
Alternative Mode: Sidewalk Width	NB direction: 5'
Landscaping Features	Tree lawn landscaping buffer between sidewalk and road on NB side of road
Land Use: Current Uses Along Project Area	Residential / Golf course along portions of east side of road
Land Use: Future Uses Along Project Area	No change
Desired Connections Along Project Area	No additional connections
Step 2: Roadway Performance	
Operations: Current ITS Infrastructure	Not applicable
Operations: Current Level of Delay or Congestion	No data available
Operations: Source of Delay or Congestion	No data available
Question: Could additional capacity be provided through TSM improvements or turn bays and intersection turn lanes?	Not applicable
Does the roadway have sufficient capacity to support current travel demands?	Yes
Does the roadway have sufficient capacity to support future travel demands?	Most likely. Consult DRCOG 2035/2040 travel projections.
Step 3: Roadway Design	
Design Guidance: Is there desired infrastructure that is not included in the current roadway design?	Sidewalks on both sides of street
Design Guidance: Are general purpose lane widths consistent with roadway design guidance?	Yes
Design Guidance: Could lane widths be reduced?	Yes, but not necessary. Lane widths could be reduced from 11' to 10'.
Site Access: What are the major traffic generators along the project area?	None
Site Access: What types of trips are generated? What time of day are trips generated?	Through traffic

Pedestrian Accommodation: Are there pedestrian generators near the project area?	None
Pedestrian Accommodation: Where are the nearest pedestrian crossings?	Castle Pines Pkwy
Pedestrian Accommodation: 'Is there adequate site access provided between and within high pedestrian areas?	There are limited opportunities to cross Buffalo Trail Rd or to access the NB sidewalk from residential areas.
Pedestrian Accommodation: Are there adequate median refuges to support pedestrian crossings?	Roadway width is modest. Refuges are not required.
Pedestrian Accommodation: Do pedestrian crossings meet local access guidance?	There are no pedestrian crossings north of Castle Pines Pkwy.
Bicycle Infrastructure: Does the corridor or location provide a critical bicycle connection?	Buffalo Trail Rd provides important north-south bicycle connection between Castle Pines Pkwy and Monarch Blvd.
Bicycle Infrastructure: Are bicycle buffers appropriate in this location?	Appropriate, but not necessary given shoulder widths
Bicycle Infrastructure: Are bicycle lanes of desired width?	Shoulders are 6', which meets guidance for desire width.

Typical Sections along Buffalo Trail Rd / Old Happy Canyon Rd



Castle Pines Pkwy west of Monarch Blvd

Background

Castle Pines Pkwy is a 4-lane arterial that runs east-west across the City of Castle Pines and connects to I-25. Traffic volumes at the eastern end of the corridor surpass 27,000 vehicles per day. There were over 6,000 vehicles per day measured in the study area in June 2015 by DRCOG.

Analysis

Castle Pines Pkwy is designed as a high speed arterial that carries traffic through the study area to residential subdivisions across western Castle Pines. However, Castle Pines Pkwy must balance a range of sometimes competing needs. It is the primary route across town, carries traffic to and from I-25, and provides access to businesses and school sites. As a result, travel speeds are often well below the speed limit. The study area is particularly impacted by the presence of Timber Trail ES to the immediate north of the corridor and west of Monarch Blvd.

Castle Pines Pkwy has a high level of capacity for a road segment that carries 6,000 vehicles per day. The modest levels of projected development in the western Castle Pines area indicate that large increases in traffic volume in coming decades through the study area are unlikely. DRCOG projections for 2040 should be consulted as they become available. Peak period volume-to-capacity ratios are well-within acceptable ranges.

Lane widths are at the high end of design guidance; lane widths are currently 12', where guidance calls for 10-12' along principal arterials. Therefore, lane widths could be narrowed to provide room for additional roadway features while remaining within acceptable limits. Narrower lanes would encourage more moderate travel speeds along Castle Pines Pkwy, and could provide safety benefits. The level of truck travel along Castle Pines Pkwy should be examined before both travel lanes are narrowed.

Pedestrian infrastructure through the study area is also limited. There are no sidewalks along the south side of the road, and there is nearly a 0.6-mile gap between marked crosswalks (from Monarch Blvd to the pedestrian beacon and marked crossing at Forest Park Dr). The current design requires pedestrians to cross at unsignalized intersections in order to access pedestrian infrastructure. No pedestrian access exists to Timber Trail ES from the south side of Castle Pines Pkwy.

Bicycle infrastructure through the study area is slightly narrower than the recommended dimensions (existing lanes are 4' in width while guidance generally calls for 5'). Improved bicycle safety could also be provided through striped bicycle buffers, which are most appropriate on high speed corridors (e.g. 40 MPH as is the case with Castle Pines Pkwy).

Recommendations

Appropriate improvements for Castle Pines Pkwy depend on whether additional right-of-way exists to enable additional roadway elements to be added, or whether improvements must be made within the existing footprint of the roadway.

If additional right-of-way is not available and preserving landscaped median is considered desirable, then improvements must be completed within the existing roadway footprint. Potential improvements that require only a striping plan include narrowing travel lanes to create additional space for cyclists. Travel lanes could be narrowed from 12' to 11' (depending on the design vehicle of the road), allowing bicycle lanes to be widened to 5' or more and creating space for striped bicycle buffers. Narrow lanes widths would likely reduce speeds slightly but improve safety conditions.

A more expensive approach includes adding sidewalk facilities along the south side of the road. If additional right-of-way is not available, space could be reallocated from the medians. Narrower medians would still afford space for median landscaping features in areas in between turn bays. The length of turn bays should also be evaluated in greater detail to determine if queue lengths are sufficient to support traffic accessing Timber Trail ES.

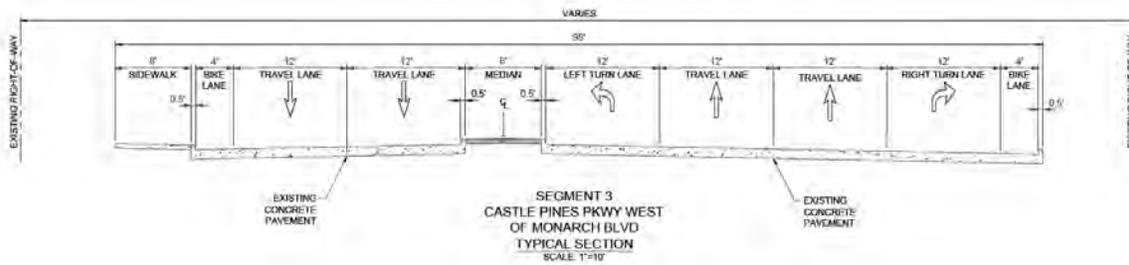
Transportation systems management improvements could also be pursued along Castle Pines Pkwy, particularly around Timber Trail ES. Options include signal timing plans that specifically serve school pick-up and drop-off times, as well as limits on turning movements during certain times of the day.

Additional pedestrian crossings could be provided at the Timber Trail ES access road; pedestrian access to the neighborhood south the school is not currently available. Median refuges already exist in this location, but there are no crosswalks or pedestrian signage.

Design Considerations	Characteristics
Step 1: Existing Conditions	
Functional Class	Principal Arterial
Available Right-of-Way	64' roadway envelope
Posted Speed	40 MPH
Roadway Configuration: Number of Travel Lanes	Two lanes per direction plus median / center turn lane
Roadway Configuration: Width of Travel Lanes	12'
Roadway Configuration: Medians and Turn Lanes	Center turn lane; raised median
Alternative Mode: Bicycle Lanes (Y/N)	Yes
Alternative Mode: Bicycle Lane Width	4'
Alternative Mode: Sidewalks (Y/N)	Yes - WB direction only
Alternative Mode: Sidewalk Width	WB direction: 6'
Landscaping Features	Median landscaping; tree lawn between road and sidewalk in WB direction
Land Use: Current Uses Along Project Area	Residential along south side of road and western section / Timber Trail ES on north side of road near Monarch Blvd
Land Use: Future Uses Along Project Area	Undeveloped land on north side of Castle Pines Pkwy
Desired Connections Along Project Area	No additional connections
Step 2: Roadway Performance	
Operations: Current ITS Infrastructure	Pedestrian beacon at Forest Park Dr
Operations: Current Level of Delay or Congestion	School-related delays
Operations: Source of Delay or Congestion	PK peak hour V/C ratio - EB = 0.5; WB = 0.6
Question: Could additional capacity be provided through TSM improvements or turn bays and intersection turn lanes?	Signal timing along Castle Pines Pkwy, including intersections of Monarch Blvd and Timber Trail ES school access road.
Does the roadway have sufficient capacity to support current travel demands?	Yes, although congestion can occur related to trips to Timber Trail ES
Does the roadway have sufficient capacity to support future travel demands?	To be determined. Consult DRCOG 2035/2040 travel projections.
Step 3: Roadway Design	
Design Guidance: Is there desired infrastructure that is not included in the current roadway design?	Sidewalks on both sides of street
Design Guidance: Are general purpose lane widths consistent with roadway design guidance?	Yes
Design Guidance: Could lane widths be reduced?	Yes. Lane widths could be reduced from 12' to 10-11'.
Site Access: What are the major traffic generators along the project area?	Timber Trail ES

Site Access: What types of trips are generated? What time of day are trips generated?	School-based trips and through traffic are major considerations.
Pedestrian Accommodation: Are there pedestrian generators near the project area?	Timber Trail ES
Pedestrian Accommodation: Where are the nearest pedestrian crossings?	Monarch Blvd, Forest Park Drive
Pedestrian Accommodation: Is there adequate site access provided between and within high pedestrian areas?	Limited pedestrian access to Timber Trail ES. Greater than ½-mile between signalized pedestrian crossings.
Pedestrian Accommodation: Are there adequate median refuges to support pedestrian crossings?	Given crossing distance, pedestrian refuges are desirable.
Pedestrian Accommodation: Do pedestrian crossings meet local access guidance?	Pedestrian refuges at crossings near Timber Trail ES.
Bicycle Infrastructure: Does the corridor or location provide a critical bicycle connection?	Castle Pines Pkwy provides critical east-west bicycle connection
Bicycle Infrastructure: Are bicycle buffers appropriate in this location?	Appropriate and desirable
Bicycle Infrastructure: Are bicycle lanes of desired width?	Lanes are currently 4' in width, which is below guidance levels. Bike buffers also desirable given 40 MPH speed limit.

Typical Sections along Castle Pines Pkwy, west of Monarch Blvd



APPENDIX C

GOALS AND OBJECTIVES DEVELOPMENT PROCESS

GOALS AND OBJECTIVES DEVELOPMENT PROCESS

Transportation Plan Goal I

Develop a safe, efficient, multifunctional transportation network designed to promote connections to local destinations

Objectives:

- Connect adjoining neighborhoods, community facilities, and services (public/private).
- Ensure consistency local, regional, and statewide transportation plans.
- Support traffic calming and streetscape design on local streets.
- Expand network connectivity with parallel east/west and north/south routes through construction of new roads or connection of existing roads.

Relationship to the Comprehensive Plan:

This goal encompasses the first half of Goal T-2 from the Comprehensive Plan and the following objectives:

- T-2 Develop an **efficient, multifunctional** transportation network designed to ensure **safety** and promote **user access**.
 - T-2.1 Encourage **road connectivity** between **adjoining neighborhoods** and **community facilities** and **services** by connecting local and collector streets, where appropriate, and minimizing the development of cul-de-sacs.
 - T-2.2 Ensure **consistency** between the Douglas County 2030 Transportation Plan, Denver Regional Council of Governments (DRCOG) 2040 Regional Transportation Plan, and local transportation plans.
 - T-2.3 Coordinate with Douglas County Schools and private schools to improve bike, pedestrian and vehicle circulation, traffic facilities, and access issues at peak times around existing and future school sites.
 - T-2.4 Support **traffic calming** and **streetscape design** on local streets to reduce traffic speeds while increasing the comfort and safety for pedestrians and bicyclists.
 - T-2.7 Strengthen the residential character outside of mixed-use areas through enhanced arterial road design using smaller lane widths, additional landscaping, and pedestrian crossings.

Transportation Plan Goal II

Facilitate cost-effective operations and roadway maintenance strategies

Objectives:

- Uphold the quality, connectivity, and maintenance of local and arterial roadways.
- Provide adequate primary, secondary, and emergency road connections for all neighborhoods.
- Improve efficiency of travel along principal arterials through smooth traffic flows (Note: this does not mean high speeds, but can mean reliable travel times)

Relationship to the Comprehensive Plan:

Goal II was developed from the second half of the Comprehensive Plan Goal T-2 and the following objectives:

- T-2 Facilitate cost-effective operations and maintenance.
 - T-2.5 Uphold the quality and maintenance of local and arterial roadways.
 - T-2.6 Provide adequate primary, secondary, and emergency road connections for all neighborhoods.

Transportation Plan Goal III

Develop bicycle infrastructure network to support increased commuting trips and serve the needs of all types of cyclists

Objectives:

- Create a continuous paved path system around the City, connecting neighborhoods, parks, schools, and commercial areas.
- Complete a system of connected on-street and off-street bicycle facilities along or parallel to major roads.
- Develop programs that encourage bicycling activity, including education and training.
- Enhance bicycle access to retail destinations, both local and regional.

Relationship to the Comprehensive Plan:

This goal was developed from the following Comprehensive Plan objectives:

- T-3.1 Create a **continuous paved path system** around the City, **connecting neighborhoods, parks, schools, and commercial areas**, and providing access to regional recreation facilities such as the Rueter-Hess Reservoir and the regional trail system.

- T-3.3 **Complete a system of connected on-street and off-street bicycle facilities along or parallel to major roads.**
- T-3.5 Establish street standards for the provision of bicycle and pedestrian improvements in all new developments.
- T-3.6 Continue to implement crossings and bike lane improvements recommended in the *Multi-Modal Enhancement Plan for Castle Pines Parkway and Monarch Boulevard*.

Transportation Plan Goal IV

Increase pedestrian connectivity, accessibility, safety, and comfort

Objectives:

- Create comfortable and safe pedestrian connections and crossings that encourage walking.
- Complete a system of connected on-street and off-street pedestrian facilities along or parallel to major roads.
- Develop programs that encourage pedestrian activity, including education and training.
- Enhance pedestrian access between neighborhoods and retail destinations.

Relationship to the Comprehensive Plan:

Goal IV incorporates the following objectives from the Comprehensive Plan:

- T-3.2 Provide landscaped medians within arterials streets, where possible, to provide safety islands where **pedestrians** can pause when crossing the streets.
- T-3.4 **Create comfortable and safe pedestrian connections and crossings that encourage walking.**
- T-3.5 Establish street standards for the provision of bicycle and pedestrian improvements in all new developments.
- T-3.6 Continue to implement sidewalks and crossings recommended in the *Multi-Modal Enhancement Plan for Castle Pines Parkway and Monarch Boulevard*.

Transportation Plan Goal V

Facilitate future opportunities for Castle Pines residents to access regional destinations via public transit

Objectives:

- Support multimodal transportation solutions to connect residents to the nearby Regional Transportation District facilities.
- Identify potential sites for public transit facilities and related pedestrian and bicycle connections.

Relationship to the Comprehensive Plan:

This goal includes Goal T-4 from the Comprehensive Plan and objective T-4.3.

- T-4 Position the community for future **public transit connections** and **commuting alternatives** that reduce traffic congestion.
 - T-4.3 **Support multimodal transportation solutions to connect residents to the nearby Regional Transportation District**

Transportation Plan Goal VI

Develop transportation infrastructure that supports mixed-use development and walkable retail centers

Objectives:

- Anticipate potential rail expansion, transit facilities, and park n' rides within Mixed-Use Downtown and Mixed-Use Market areas.
- Enhance vehicular and pedestrian connectivity and mobility within all mixed-use areas
- Encourage transit-supportive densities and mixed-use development near the interchange of I-25 and Castle Pines Parkway and other potential transit station areas.

Relationship to the Comprehensive Plan:

Goal IV encompasses the following Comprehensive Plan objectives:

- T-2.8 Enhance vehicular and pedestrian connectivity and mobility within all Mixed-Use land uses by designing smaller blocks with a fine grain street network.
- T-4.2 Encourage transit-supportive densities and mixed-use development near the interchange of I-25 and Castle Pines Parkway.
- T-4.1 Anticipate potential rail expansion, transit facilities, and park n' rides within Mixed-Use Downtown and Mixed-Use Market areas.